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REPORT OF INVESTIGATION
FOR
GROUND WATER QUALITY ASSESSMENT
AT THE
KOCH FUELS, INC. TERMINAL
RIVER ROAD, WILMINGTON, NORTH CAROLINA

JUNE 27, 1986

PREPARED BY:

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Richard Catlin & Associates, Inc.

CONSULTING ENGINEERS AND HYDROGEOLOGISTS

RC&A

July 10, 1986

N. C. Department of Natural Resources
and Community Development
Department of Environmental Management
ATTN: Mr. Rick Shiver
7225 Wrightsville Avenue
Wilmington, N. C. 28403-3696

Dear Mr. Shiver:

Enclosed please find three (3) copies of the Report of Investigation for Ground Water Quality Assessment at the Koch Fuels, Inc. Terminal on River Road in Wilmington, N. C.

We will be contacting you in the near future to discuss our recommendations regarding this project.

Sincerely,

Richard G. Catlin, P.E., P.G.
President

Enclosures

cc:
Mr. Jim Strickland

RGC/nd

P.O. Box 557 7225 Wrightsville Ave., Suite 127 Wrightsville Beach, N.C. 28480 (919) 256-5878

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KOCH FUELS, INC. TERMINAL
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JUNE 27, 1986

PURPOSE:

THIS REPORT DESCRIBES THE FINDINGS OF A GROUND WATER QUALITY ASSESSMENT UNDERTAKEN AT THE KOCH FUEL TERMINAL ON RIVER ROAD IN WILMINGTON, N. C.

A PRELIMINARY INVESTIGATION, COMPLETED MARCH 6, 1986, FOUND TWO AREAS OF PROBABLE GROUND WATER CONTAMINATION TO EXIST IN THE VICINITY OF THE SOUTHERN TANK FARM AREA NEAR TANKS #1 AND #4.

THE INITIAL FOCUS OF THIS STUDY WAS TO MORE ACCURATELY DELINEATE THE GROUND WATER SITUATION NEAR TANKS #1 AND #4, AND TO DESCRIBE RECOMMENDATIONS FOR ANY NEEDED REMEDIAL MEASURES. DURING THE COURSE OF THIS INVESTIGATION, SEVERAL OLD WELLS (CONSTRUCTED AS PART OF A 1981 PARAXYLENE SPILL RECOVERY PROJECT WHEN THE TERMINAL WAS OWNED BY SUN REFINING AND MARKETING COMPANY) WERE SURVEYED AND MEASURED TO AUGMENT GROUND WATER FLOW DATA. WHEN MEASURED, THESE WELLS SHOWED PRODUCT ACCUMULATIONS. CONSEQUENTLY, THE SCOPE OF THIS INVESTIGATION WAS EXPANDED TO INCLUDE ALL EXISTING WELLS IN THE NORTH TANK FARM AREA. FIGURE 1 SHOWS THE TOTAL PROJECT AREA

INCLUDING THE INITIAL STUDY FOCUS IN THE SOUTHERN TANK FARM, AS WELL AS THE NORTHERN PORTION OF THE KOCH TERMINAL WHERE THE 1981 PARAXYLENE SPILL WAS INVESTIGATED AND RECOVERED. FIGURES 2 AND 3 SHOW SPECIFIC MONITORING WELLS IN THE NORTH AND SOUTH AREA RESPECTIVELY. SPECIFICALLY, THIS INVESTIGATION SOUGHT TO DETERMINE THE LOCATION AND SPATIAL DISTRIBUTION OF SUBSURFACE CONTAMINATION, ANTICIPATED DIRECTIONS OF POSSIBLE MIGRATION, AND SPECIFIC REMEDIAL MEASURES FOR CONTAINMENT AND RECOVERY.

METHODS OF INVESTIGATION:

INVESTIGATIVE METHODS UTILIZED TO GATHER DATA PERTINENT TO THE GOALS OF THIS INVESTIGATION INCLUDED THE FOLLOWING:

1) MONITORING WELLS -

IN ORDER TO OBTAIN NECESSARY SUBSURFACE INFORMATION, ELEVEN (11) ADDITIONAL MONITORING WELLS WERE INSTALLED AS PART OF THIS INVESTIGATION. ALONG WITH THE THIRTEEN (13) WELLS INSTALLED AS PART OF THE PHASE I (MARCH 6, 1986) INVESTIGATION, A TOTAL OF 24 MONITORING WELLS WERE INSTALLED IN THE SOUTHERN TANK FARM AREA OF THE KOCH TERMINAL (SEE FIGURE 3).

THESE WELLS WERE INSTALLED BY ROTARY DRILL AND HOLLOW CORE AUGER. SEDIMENTS WERE EXAMINED FROM CUTTINGS BY THE WELL DRILLER AND BY PROJECT GEOLOGISTS, BOTH IN THE

FIELD AND FROM SAMPLES EXAMINED IN THE OFFICE.

ALL WELLS WERE DRILLED TO A TOTAL DEPTH OF APPROXIMATELY 20 FEET AND WERE CONSTRUCTED OF 2" P.V.C. SCREEN AND RISER PIPE. AT THE TERMINATION OF EACH BORING, 15' OF 10 SLOT P.V.C. WELL SCREEN WAS INSERTED INTO THE BORING TO ASSURE THAT THE WATER TABLE WOULD FALL WELL WITHIN THE UPPER AND LOWER LIMITS OF THE SCREENED INTERVAL. APPROXIMATELY 6' TO 7' OF 2" P.V.C. RISER PIPE WAS INSTALLED TO BRING THE WELL TO ABOVE GROUND SURFACE. CLEAN MEDIUM SAND WAS INSTALLED IN THE ANNULAR SPACE AROUND THE SCREEN TO AT LEAST A FOOT ABOVE THE TOP OF THE WELL SCREEN. EACH WELL WAS COMPLETED WITH A BENTONITE SEAL AND GROUTED TO LAND SURFACE. ALL WELLS WERE CONSTRUCTED THROUGH HIGH RISE SERVICE COMPANY BY DALE TODD DRILLING COMPANY OR CAROLINA DRILLING COMPANY.

ADDITIONAL DATA WAS OBTAINED FROM MONITORING WELLS REMAINING FROM A 1981 PARAXYLENE SPILL RECOVERY PROJECT IN THE NORTHERN PROJECT AREA (SEE FIGURE 2).

2) HYDROGEOLOGIC DATA COLLECTION -

THE SITE WAS SURVEYED AND TOP OF CASING ELEVATIONS FOR EACH WELL WERE MEASURED RELATIVE TO AN ASSUMED BENCH-

MARK (ELEVATION 100.00'). DEPTHS TO THE WATER TABLE FROM THE TOP OF CASING, AS WELL AS ANY THICKNESS OF PRODUCT ACCUMULATIONS WERE MEASURED FOR EACH WELL AFTER ALLOWING WATER TABLE ELEVATIONS TO STABILIZE IN THE COMPLETED WELLS.

ELEVATION DATA FOR THE WATER TABLE SURFACE WAS REDUCED AND PLOTTED IN MAP FORM TO YIELD A REPRESENTATION OF THE WATER TABLE SURFACE AND TO PROVIDE INSIGHT INTO POSSIBLE MIGRATION DIRECTIONS OF CONTAMINATED GROUND WATER. WATER TABLE ELEVATIONS IN WELLS WITH PRODUCT ACCUMULATIONS WERE ADJUSTED FOR SPECIFIC GRAVITY INFLUENCES TO PROVIDE REPRESENTATIVE HYDRAULIC GRADE LINES OF THE SURFICIAL AQUIFER.

TWO PUMP TESTS WERE CONDUCTED TO ESTIMATE HYDRAULIC CONDUCTIVITY. WELL #5 WAS PUMPED FOR 6 HOURS AT A RATE OF 8.5 GALLONS PER MINUTE (GPM) AND DRAWDOWN WAS OBSERVED IN NEARBY MONITORING WELLS AROUND TANK #4.

ADDITIONALLY, WELL #17 WAS PUMPED FOR 4 HOURS AT A RATE OF 7.5 GPM TO OBSERVE RESPONSE IN MONITORING WELLS NEAR TANK #1.

3) GROUND WATER SAMPLING -

A TEFLON BAILER, RESISTIVITY PROBE AND A STEEL TAPE WITH WATER FINDING PASTE AND GAS SENSITIVE PASTE WERE UTILIZED TO DETERMINE PRODUCT ACCUMULATION IN THE COMPLETED MONITORING WELLS. THIS DATA WAS PLOTTED IN MAP FORM TO APPROXIMATELY DELINEATE OBSERVED FREE PRODUCT ZONES.

WHERE UNEXPECTED ACCUMULATIONS WERE FOUND, A SAMPLE OF PURE COMPOUND WAS OBTAINED AND ANALYZED FOR PRODUCT IDENTIFICATION.

ALL WELLS WERE BAILED AND SAMPLED FOR ANALYSIS BY LAW & COMPANY, ANALYTICAL CHEMISTS.

WELLS IN THE SOUTHERN STUDY AREA WERE ANALYZED FOR THE FOLLOWING:

- BENZENE
- TOLUENE
- XYLENE
- EDB (1,2 DIBROMOETHANE)
- MTBE (T. BUTYL METHYL ETHER)
- NAPHTHA
- #2 FUEL OIL

WELLS IN THE NORTHERN STUDY AREA WERE ANALYZED FOR THE FOLLOWING:

- o BENZENE
- o TOLUENE
- o XYLENE
- o MTBE (T. BUTYL METHYL ETHER)
- o EDB (1,2 DIBROMOETHANE)
- o #2 FUEL OIL

4) LITERATURE SEARCH -

ADDITIONAL HYDROGEOLOGIC DATA WAS OBTAINED BY EVALUATING EXISTING REPORTS OF GROUND WATER INVESTIGATIONS FROM PREVIOUS RECOVERY PROJECTS.

DATA EVALUATION PROCEDURES:

INFORMATION OBTAINED DURING THIS INVESTIGATION WAS COMPILED AND EVALUATED USING THE FOLLOWING PROCEDURES:

1) WELL LOGS AND SEDIMENT SAMPLES WERE UTILIZED IN THE DEVELOPMENT OF SUBSURFACE HYDROGEOLOGIC CROSS SECTIONS.

2) MONITORING WELL WATER TABLE MEASUREMENTS WERE USED IN THE DEVELOPMENT OF A WATER TABLE CONTOUR MAP.

3) ESTIMATES OF TRANSMISSIVITY WERE CALCULATED FROM PUMP TEST DATA USING THE BOULTON PRICKET TYPE CURVE SOLUTION METHOD FOR WATER TABLE AQUIFERS.

4) WATER QUALITY DATA WAS EVALUATED AND SIGNIFICANT CONSTITUENTS AND PARAMETERS WERE CONTOURED ON INDIVIDUAL MAPS.

5) PURE COMPOUND (FREE PRODUCT) ACCUMULATIONS WERE CONTOURED AND PRESENTED IN MAP FORM.

FINDINGS OF INVESTIGATIONS:

1) TOPOGRAPHY - THE LAND SURFACE FALLS TOWARD THE WEST-NORTHWEST, RANGING FROM 44' (MSL) NEAR TANK #2 TO 22' NEAR THE SOUTH GATE OF THE NORTH CAROLINA STATE PORTS PROPERTY.

SURFACE DRAINAGE IN THE TANK FARM AREAS OCCURS PRIMARILY THROUGH INFILTRATION OF RAINFALL TO THE SURFICIAL AQUIFER.

2) SUBSURFACE FINDINGS -

A) SEDIMENTS - FIGURE 4-A SHOWS THE LOCATION OF HYDROGEOLOGIC CROSS SECTION A-A'. SEDIMENTS ENCOUNTERED WITHIN THE UPPER PART OF THE SURFICIAL AQUIFER (FIGURE 4) CONSIST OF FINE TO MEDIUM SANDS.

B) WATER TABLE - GROUND WATER WAS MEASURED AT APPROXIMATELY 8 TO 12 FEET BELOW GROUND SURFACE IN THE

SOUTHERN PROJECT AREA AND ROUGHLY 4 TO 10 FEET IN THE NORTHERN PROJECT AREA.

GROUND WATER FLOW IS TOWARD THE NORTHWEST, FALLING 17 FEET ACROSS THE PROJECT. THE AVERAGE GROUND WATER GRADIENT IN THE SOUTH STUDY AREA WAS MEASURED TO BE 0.8% (SEE FIGURE 6) WHILE THE AVERAGE GROUND WATER GRADIENT IN THE NORTH STUDY AREA WAS MEASURED TO BE 1.8% (SEE FIGURE 5). AVERAGE WATER TABLE SLOPE ACROSS THE ENTIRE PROJECT WAS FOUND TO BE ROUGHLY 1.4%.

3) REGIONAL SUBSURFACE GEOLOGY:

AVAILABLE LITERATURE SUGGESTS THAT IN THE VICINITY OF THIS PROJECT 20 - 40 FEET OF UNDIFFERENTIATED LATE TERTIARY AND SURFICIAL DEPOSITS OVERLAY THE CASTLE HAYNE LIMESTONE FORMATION.

AN EARLIER INVESTIGATION IN 1982 SUGGESTS THAT A THIN CLAY LAYER MAY SEPARATE THESE UPPER SANDS FROM THE LIMESTONE BELOW.

THE CASTLE HAYNE LIMESTONE DEPOSIT MAY BE AS MUCH AS 50 FEET THICK IN THIS SECTION OF THE COUNTY. THE CASTLE HAYNE FORMATION IS REPORTEDLY SEPARATED FROM THE FRESH WATER OF THE PEEDEE FORMATION BELOW BY A CLAY

AQUICLUDE WHICH IS APPROXIMATELY 50' THICK.

NO BORINGS WERE MADE DURING THIS INVESTIGATION TO SUBSTANTIATE THESE FINDINGS. THIS SUBSURFACE DESCRIPTION WAS INTERPOLATED FROM INFORMATION FOUND IN "GROUND WATER BULLETIN 17, NORTH CAROLINA DEPARTMENT OF WATER AND AIR RESOURCES, 1970".

4) HYDROGEOLOGIC FINDINGS: PUMP TEST CALCULATIONS (SEE APPENDIX) GIVE AN APPROXIMATE VALUE OF HYDRAULIC CONDUCTIVITY (K) OF 400 GPD/FT^2 FOR THE SURFICIAL AQUIFER. THIS VALUE WAS DETERMINED FROM THE PUMP TEST DATA OBTAINED NEAR TANK #4.

BASED ON OBSERVED GRADIENT, FLOW RATES ARE CALCULATED TO BE LESS THAN 4 FT/DAY. CONTAMINANT MIGRATION RATES DO NOT NECESSARILY EQUAL THIS RATE.

5) GROUND WATER QUALITY - WATER QUALITY DATA FROM LABORATORY ANALYSIS OF SAMPLES TAKEN FROM MONITORING WELLS HAS BEEN SUMMARIZED IN MAP FORM FOR SIGNIFICANT CONTAMINANT ISOCONS ON FIGURES 7 THROUGH 14. CONCENTRATION LEVELS FOR EDB, MTBE AND NAPHTHA DID NOT JUSTIFY INDIVIDUAL ISOCONS. FINDINGS ARE DESCRIBED AS FOLLOWS:

FIGURES 7 & 8 SHOW ISOCONS OF BENZENE IN GROUND WATER SAMPLES. NOTE THE APPEARANCE OF A PLUME OF BENZENE EXTENDING FROM TANK #1 (FIGURE 8) TOWARD

THE NORTHWEST AND DISSIPATING IN THE VICINITY OF WELL #E-41 (FIGURE 7).

A PLUME OF LESSER CONCENTRATION OCCURS NEAR TANK #4 (FIGURE 8).

FIGURES 9 & 10 DEPICT ISOCONS OF TOLUENE IN THE WATER TABLE AQUIFER. AS WITH BENZENE ISOCONS, TOLUENE CONCENTRATIONS INDICATE A PLUME EXTENDING INTO THE NORTHERN PROJECT AREA FROM TANK #1 (FIGURE 10).

ANOTHER PLUME OF TOLUENE IS EVIDENT NEAR TANK #4 WITH GREATEST CONCENTRATIONS AROUND WELL #22.

FIGURES 11 AND 12 SHOW XYLENE CONCENTRATIONS EXTENDING FROM AREAS AROUND TANK #1 AND TANK #4 MUCH THE SAME AS INDICATED BY BENZENE AND TOLUENE ISOCONS EXCEPT THAT XYLENE CONCENTRATIONS INCREASE SUBSTANTIALLY IN THE NORTHWESTERN PROJECT AREA WHERE BENZENE AND TOLUENE WERE NOT DETECTED AT ALL.

THE XYLENE PLUME IN THE NORTHERN PROJECT AREA EXTENDS ACROSS RIVER ROAD TOWARD THE SOUTH GATE OF THE N. C. STATE PORTS PROPERTY. THE BOUNDARIES OF THIS PLUME ARE UNKNOWN AT PRESENT.

FIGURES 13 AND 14 SHOW CONCENTRATIONS OF DISSOLVED #2 FUEL OIL. WHILE LOW CONCENTRATION PLUMES EXIST NEAR TANKS #1 AND #4, A MUCH HIGHER CONCENTRATION OF DISSOLVED FUEL OIL IS EVIDENT IN THE NORTH PROJECT AREA, CENTERED AROUND WELLS E-71 AND E-70. THIS PLUME APPEARS TO BE SUBSTANTIALLY LIMITED TO THE KOCH FUEL TERMINAL PROPERTY FROM THE DATA AVAILABLE, ALTHOUGH IT IS POSSIBLE THAT SOME MIGRATION ACROSS RIVER ROAD MAY HAVE OCCURRED.

6) PURE COMPOUND PLUMES

FOUR (4) FREE FLOATING PRODUCT (PURE COMPOUND) PLUMES WERE FOUND DURING THIS INVESTIGATION. FIGURE 15 SHOWS A FREE PRODUCT PLUME CENTERED AROUND AN OLD PUMPING WELL DESIGNATED E-PW, AS WELL AS A FREE PRODUCT PLUME ACROSS RIVER ROAD TO THE NORTHWEST.

FIGURE 16 SHOWS TWO PLUMES OF LESSER FREE PRODUCT THICKNESS NEAR TANKS #1 AND #4. IT IS INTERESTING TO NOTE THAT SEVERAL MONTHS AGO OVER 1.0' OF FREE PRODUCT WAS OBSERVED IN MONITORING WELL #5 NEAR TANK #4.

SAMPLES OF FREE PRODUCT ANALYZED IN THE LABORATORY FOR THE NORTHERN AREA YIELDED THE FOLLOWING:

TABLE I

FREE PRODUCTS ANALYSIS

WELL #	#2 FUEL OIL %	PARAXYLENE/ XYLENE %	GASOLINE %
E-28	2.0	98.0	<.1
E-80	3.4	96.6	<.1
ERW-8	5.80	94.12	<.1
E-41	12.9	87.1	<.1
E-42	26.0	74.0	<.1
E-11	76.22	18.96	4.82
E-71	61.4	37.8	0.80

DISCUSSION OF FINDINGS:

THE FINDINGS OF THIS INVESTIGATION INDICATE THAT GROUND WATER CONTAMINATION DOES EXIST AT THIS SITE.

A VERY GENERALIZED COMPOSITE DATA SUMMARY MAP IS ATTACHED AS FIGURE 17 OF THIS REPORT. THIS MAP SHOWS FOUR AREAS OF GROUND WATER CONTAMINATION. WHILE SOME OF THESE AREAS OVERLAP IN EXTENT, THEY HAVE BEEN SEPARATED INTO PLUMES 1, 2, 3 AND 4 FOR REFERENCE PURPOSES. SPECIFICALLY, THE FOLLOWING SUMMARIZES OBSERVED GROUND WATER CONTAMINATION CONDITIONS AT THE WILMINGTON KOCH FUEL TERMINAL:

PLUME CHARACTERISTICS -

PLUME #1 - FROM AVAILABLE DATA, THIS PLUME APPEARS TO CONSIST PRIMARILY OF GASOLINE. FREE PRODUCT DOES OCCUR IN THIS PLUME ALTHOUGH RECENT MEASUREMENTS SHOW ONLY TRACE AMOUNTS.

PLUME #2 - BENZENE, TOLUENE AND XYLENE OCCUR IN THIS AREA SUGGESTING GASOLINE CONTAMINATION. BOTH NAPHTHA AND #2 FUEL OIL WERE ALSO IDENTIFIED AS CONSTITUENTS OF THIS PLUME. FREE FLOATING PRODUCT DOES OCCUR IN THIS AREA. THIS PRODUCT APPEARS TO BE MORE MISCIBLE THAN WOULD BE EXPECTED FOR A PLUME CONSISTING PRIMARILY OF GASOLINE.

PLUME #3 - CONSISTS PRIMARILY OF #2 FUEL OIL IN THE SOUTHERN ONE-HALF OF THE PLUME, GRADING TO PARAXYLENE TO THE NORTH. GASOLINE IS ALSO A CONSTITUENT OF THE SOUTHERN PORTION OF THE PLUME (SEE TABLE I). FREE FLOATING PRODUCT WAS MEASURED IN THIS PLUME TO BE FROM 1' TO 4' THICK IN EXISTING WELLS.

PLUME #4 - GRADES FROM A MIXTURE OF PARAXYLENE AND #2 FUEL OIL TO ALMOST PURE PARAXYLENE WEST OF RIVER ROAD (SEE TABLE I). FREE PRODUCT IN EXISTING WELLS WAS MEASURED WEST OF RIVER ROAD TO BE OVER 2 FEET THICK.

PLUME GEOMETRY -

ALL FOUR PLUMES APPEAR TO BE MIGRATING TOWARD THE NORTHWEST WITH THE DIRECTION OF GROUND WATER FLOW. BOUNDARY DELINEATION FOR ALL PLUMES ARE APPROXIMATE WITH VARYING DEGREES OF CONFIDENCE.

PLUME #1 - THIS PLUME BOUNDARY CAN BE INFERRED TO EXIST SUBSTANTIALLY WITHIN THE CONTAINMENT AREA OF TANK #4 AT THE TIME OF THIS INVESTIGATION.

PLUME #2 - PLUME #2 APPEARS TO EXTEND FROM TANK #1 TOWARD PLUME #3. SUFFICIENT DATA POINTS DO NOT EXIST TO BE CERTAIN OF THIS PLUME GEOMETRY BUT AVAILABLE DATA FITS REASONABLY WELL WITH WATER TABLE FLOW TRENDS.

PLUME #3 - THIS PLUME APPEARS TO BE SUBSTANTIALLY ON KOCH PROPERTY; HOWEVER, MONITORING WELLS TO THE WEST TOWARD RIVER ROAD DO NOT EXIST TO ALLOW FOR A CONCLUSION AS TO THE EXTENT OF WESTWARD MIGRATION.

PLUME #4 - APPARENTLY ORIGINATING FROM THE PLUME #3 AREA, BOUNDARIES TO THE WEST AND NORTH ARE COMPLETELY UNKNOWN AT PRESENT.

PLUME MIGRATION

ALL FOUR PLUMES ARE MIGRATING NORTHWESTWARD. PLUMES #1 AND #2 HAD NOT APPARENTLY MIGRATED OFFSITE AT THE TIME OF THIS INVESTIGATION. PLUME #3 MAY STILL BE CONTAINED ON KOCH PROPERTY BUT ADDITIONAL DATA IS REQUIRED TO DELINEATE A WESTERN BOUNDARY.

PLUME #4 HAS DEFINITELY MIGRATED OFFSITE TO THE WEST AND THE NORTH. BOUNDARIES ARE AT PRESENT COMPLETELY UNKNOWN AND MIGRATION IS EXPECTED TO CONTINUE TO THE NORTHWEST.

RECOMMENDATIONS:

THE FOLLOWING RECOMMENDATIONS ARE PROPOSED AS A RESULT OF THIS ASSESSMENT:

1) EMERGENCY MEASURES - THE EXISTING RECOVERY WELL, DESIGNATED ERW-8 (SEE FIGURE 15), LOCATED WEST OF RIVER ROAD, SHOULD BE REACTIVATED. A TWO PUMP SYSTEM UTILIZING AN EXISTING WATER TABLE DEPRESSION PUMP AND FLOATING SCAVENGER PUMP IS PROPOSED TO CREATE A HYDRAULIC SINK IN THIS AREA TO CAPTURE AND REMOVE AS MUCH CONTAMINATION AS POSSIBLE. DISCHARGE FROM THE WATER TABLE DEPRESSION PUMP IS PROPOSED TO NEARBY SURFACE WATER DRAINAGE.

2) ASCERTAIN PLUME EXTENT - AS SOON AS POSSIBLE, ADDITIONAL MONITORING WELLS ARE PROPOSED TO DELINEATE UNKNOWN

PLUME BOUNDARIES AND TO EVALUATE THE EFFECTIVENESS OF EMERGENCY RECOVERY OPERATIONS. PERMITS FOR THESE ADDITIONAL MONITORING WELLS WILL BE FILED WITH THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT, CONCURRENT WITH THE START-UP OF RECOVERY OPERATIONS AT RECOVERY WELL #ERW-8.

3) RECOVERY SYSTEMS, PLUMES #1, #2 AND #3:

AS SOON AS EMERGENCY RECOVERY IS UNDERWAY ACROSS RIVER ROAD (PLUME #4), PERMITS FOR RECOVERY WELLS FOR PLUMES #1, #2 AND #3 ARE PROPOSED TO BE FILED WITH THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT. FIGURE 17 SHOWS PROPOSED LOCATIONS OF INITIAL RECOVERY WELLS; WHEN THESE RECOVERY WELLS ARE INSTALLED, PUMP TESTS AND PUMP DESIGNS, ALONG WITH CONSTRUCTION OF PURE COMPOUND RECOVERY SYSTEMS; CAN BEGIN. EXACT DETAILS OF EACH RECOVERY SYSTEM WILL BE DEVELOPED AFTER FIELD TESTING OF THE RECOVERY WELL IS COMPLETE;

4) INSURE SOURCE REMOVAL - LINE TESTING AND TANK INSPECTION OPERATIONS UNDERWAY SHOULD CONTINUE UNTIL ALL SOURCES OF CONTAMINATION HAVE BEEN IDENTIFIED AND ELIMINATED.

5) REPAIR EXISTING MONITORING WELLS - ALL EXISTING WELLS WITH "E" DESIGNATIONS ARE PROPOSED TO BE BROUGHT UP TO STATE STANDARDS BY THE INSTALLATION OF LOCKING WELL SHIELDS;

6) UPDATE ASSESSMENT - WHEN ALL BOUNDARIES OF CONTAMINATION HAVE BEEN DELINEATED, AND ALL RECOVERY SYSTEMS ARE OPERATIONAL, AN UPDATE GROUND WATER ASSESSMENT REPORT SHOULD BE PREPARED TO EVALUATE EFFECTIVENESS OF INITIAL EFFORTS AND TO RECOMMEND ADDITIONAL MEASURES, AS NECESSARY.

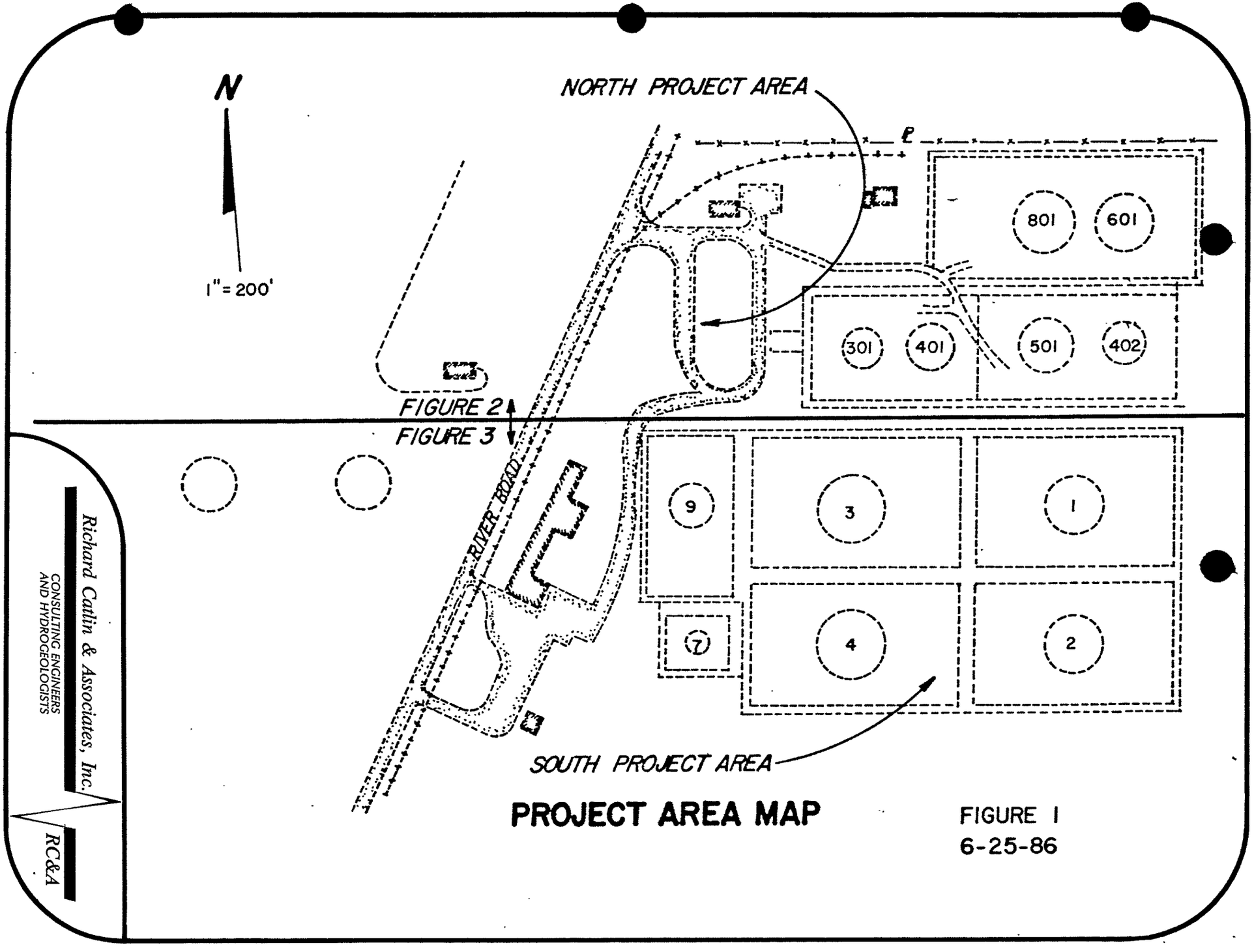
7) MONITOR RECOVERY OPERATIONS - AS RECOVERY PROCEEDS, MEASURE PLUME BOUNDARIES, DETERMINE CONTAMINANT CAPTURE SUCCESS (I.E. WATER TABLE SURFACE AND FLOW DIRECTIONS) AND RECOVERY VOLUMES MONTHLY AND PROVIDE WRITTEN MONTHLY REPORT TO TRACK CLEAN-UP PROGRESS.

LIMITATIONS OF INVESTIGATION:

THE BORINGS MADE AS PART OF THIS INVESTIGATION ONLY PROVIDE ISOLATED DATA POINTS AND MAY NOT REPRESENT SUBSURFACE CONDITIONS AT EVERY LOCATION IN THE PROJECT AREA. ANALYSIS AND CONCLUSIONS OF THIS REPORT ARE BASED ON INTERPOLATION BETWEEN DATA POINTS AND MAY NOT BE COMPLETELY REPRESENTATIVE OF ALL SUBSURFACE CONDITONS.

THIS INVESTIGATION FURTHERMORE DOES NOT PROVIDE CONCLUSIVE DATA ON LIMITS OF CONTAMINATION OR OTHER INTERPOLATIONS WHERE INDICATED BY QUESTION MARKS, OR WHERE OTHERWISE QUALIFIED.

CONCLUSIONS AND RECOMMENDATIONS OF THIS INVESTIGATION AND REPORT ARE BASED ON THE BEST AVAILABLE DATA IN AN EFFORT TO ASSIST IN THE UNDERSTANDING, CONTROL AND/OR CLEAN-UP OF AN EXISTING PROBLEM. NO GUARANTEE IS EXPRESSED OR IMPLIED THAT NEW OR ADDITIONAL DATA AND/OR REMEDIAL MEASURES WILL NOT BE REQUIRED FOR ULTIMATE SOLUTION OF THE EXISTING CONTAMINATION PROBLEM OR PROJECT.



PROJECT AREA MAP

FIGURE 1
6-25-86

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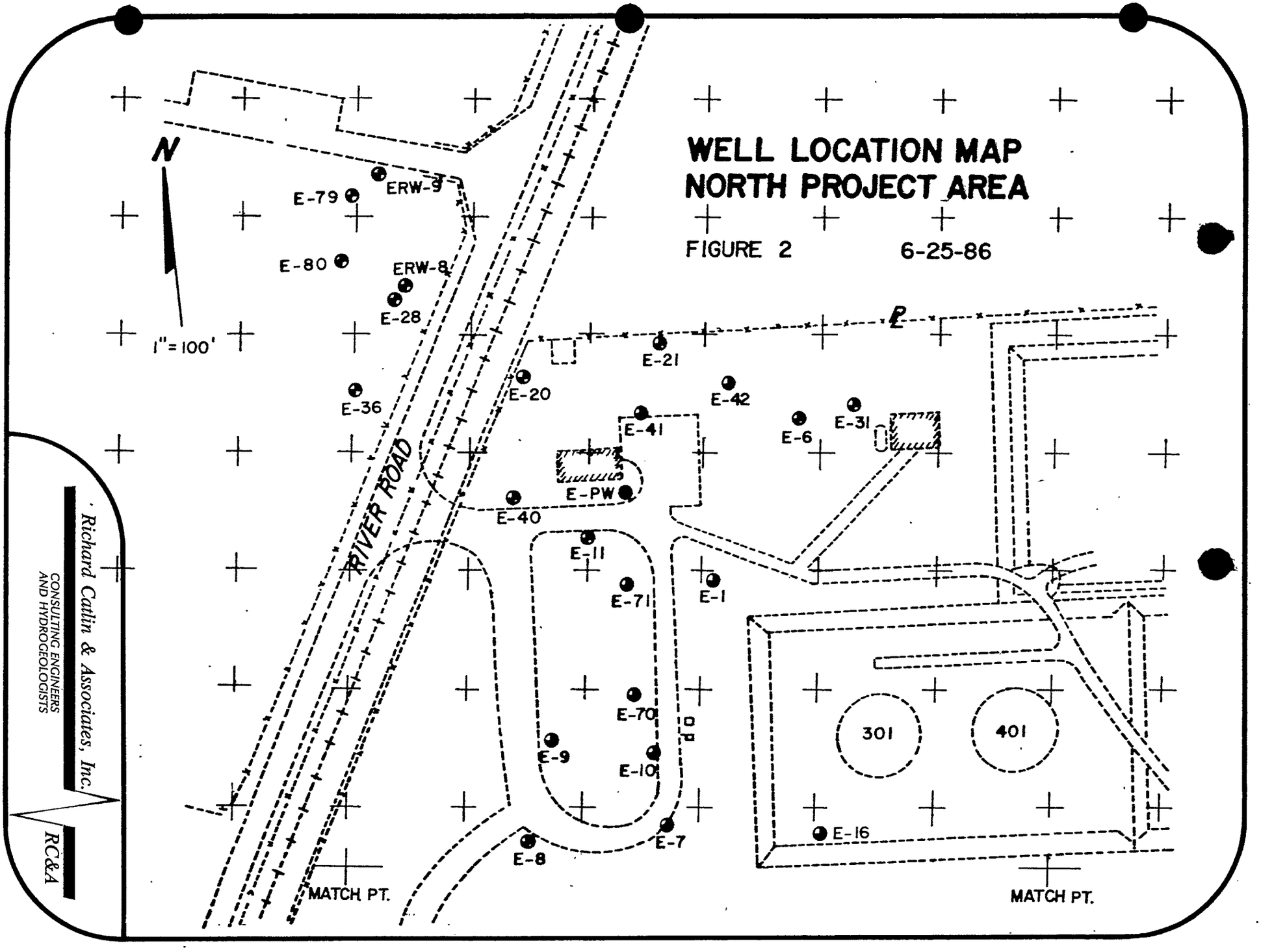
WELL LOCATION MAP
NORTH PROJECT AREA
FIGURE 2
6-25-86
N
1"=100'
E-79
ERW-9
E-80
ERW-8
E-28
E-36
E-20
E-21
E-42
E-41
E-6
E-31
E-PW
E-40
E-11
E-71
E-1
E-70
E-9
E-10
E-7
E-8
E-16
RIVER ROAD
301
401
MATCH PT.
MATCH PT.
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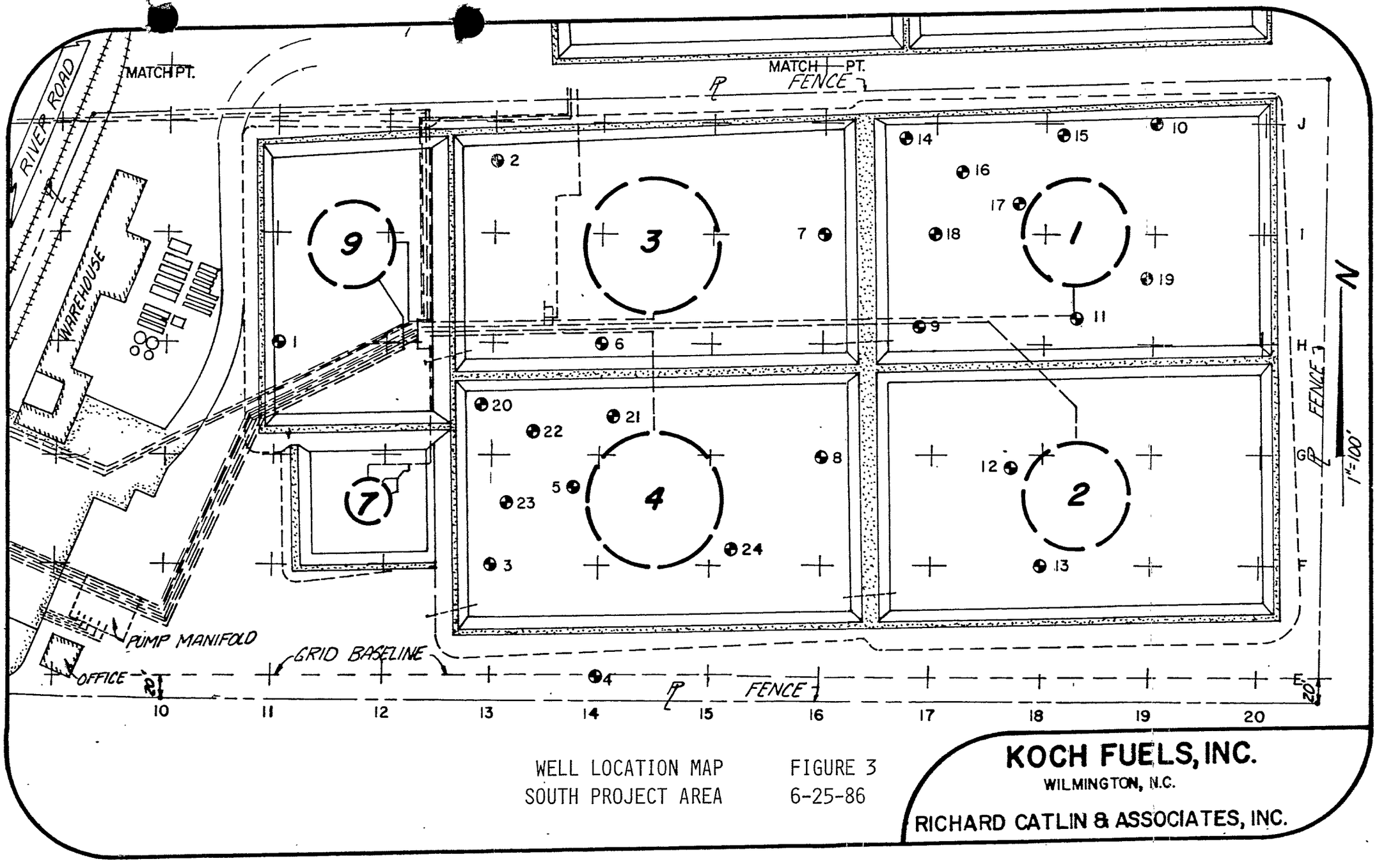

WELL LOCATION MAP
SOUTH PROJECT AREA

FIGURE 3
6-25-86

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WILMINGTON, N.C.

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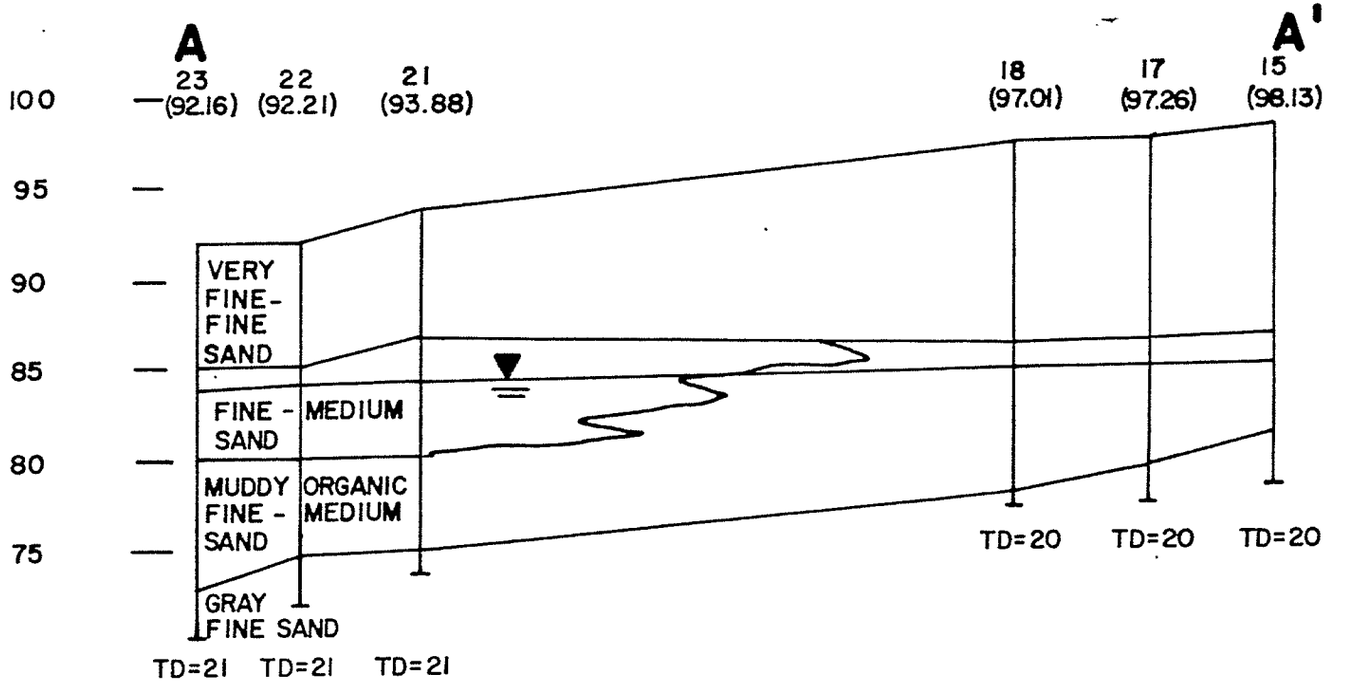

HYDROGEOLOGIC CROSS SECTION A-A'

FIGURE 4

HORIZONTAL SCALE 1" = 100'

6-24-86

LEGEND

TD = TOTAL DEPTH CASED

( ) = GROUND ELEVATION

▼ = WATER TABLE

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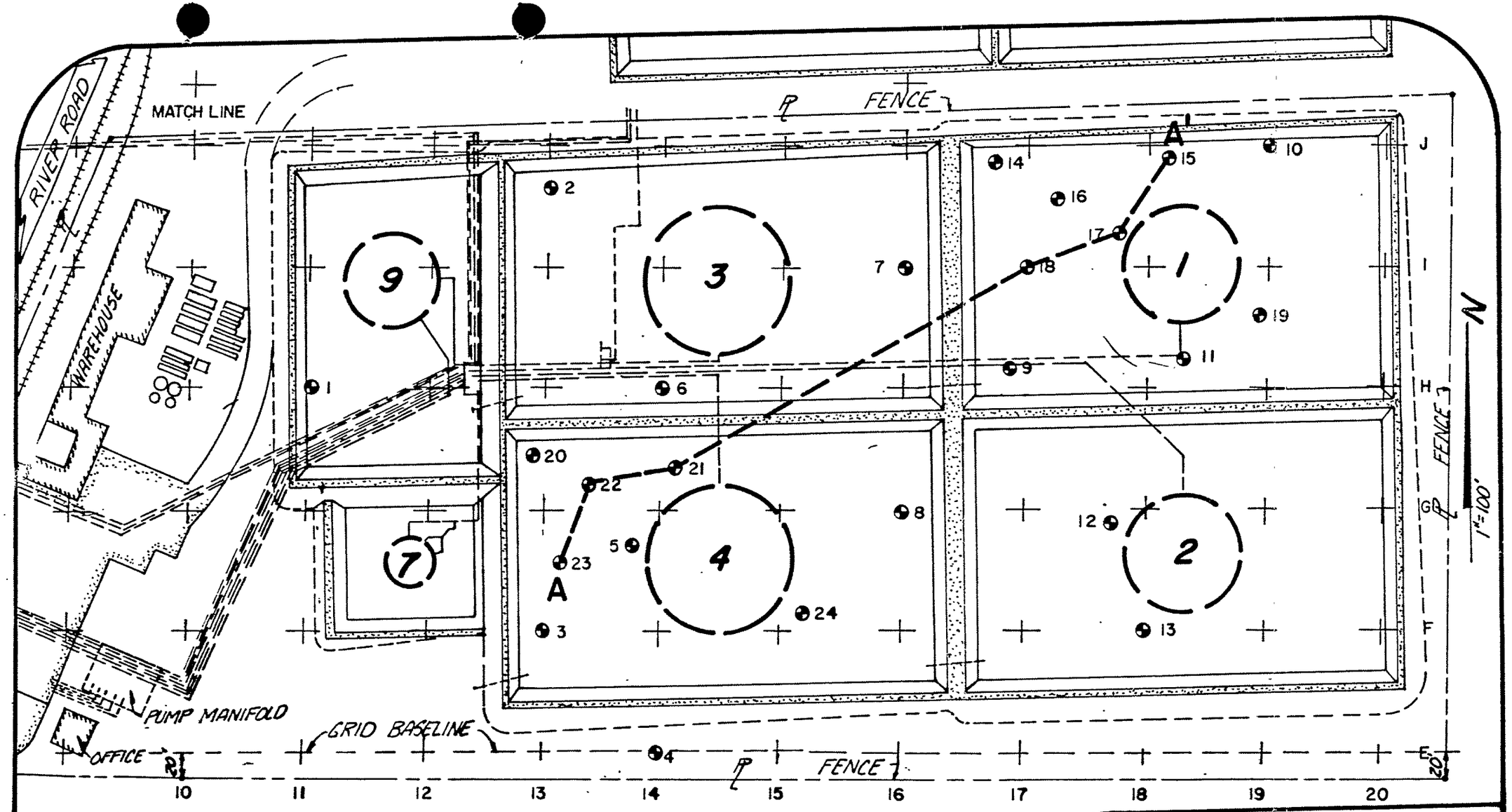
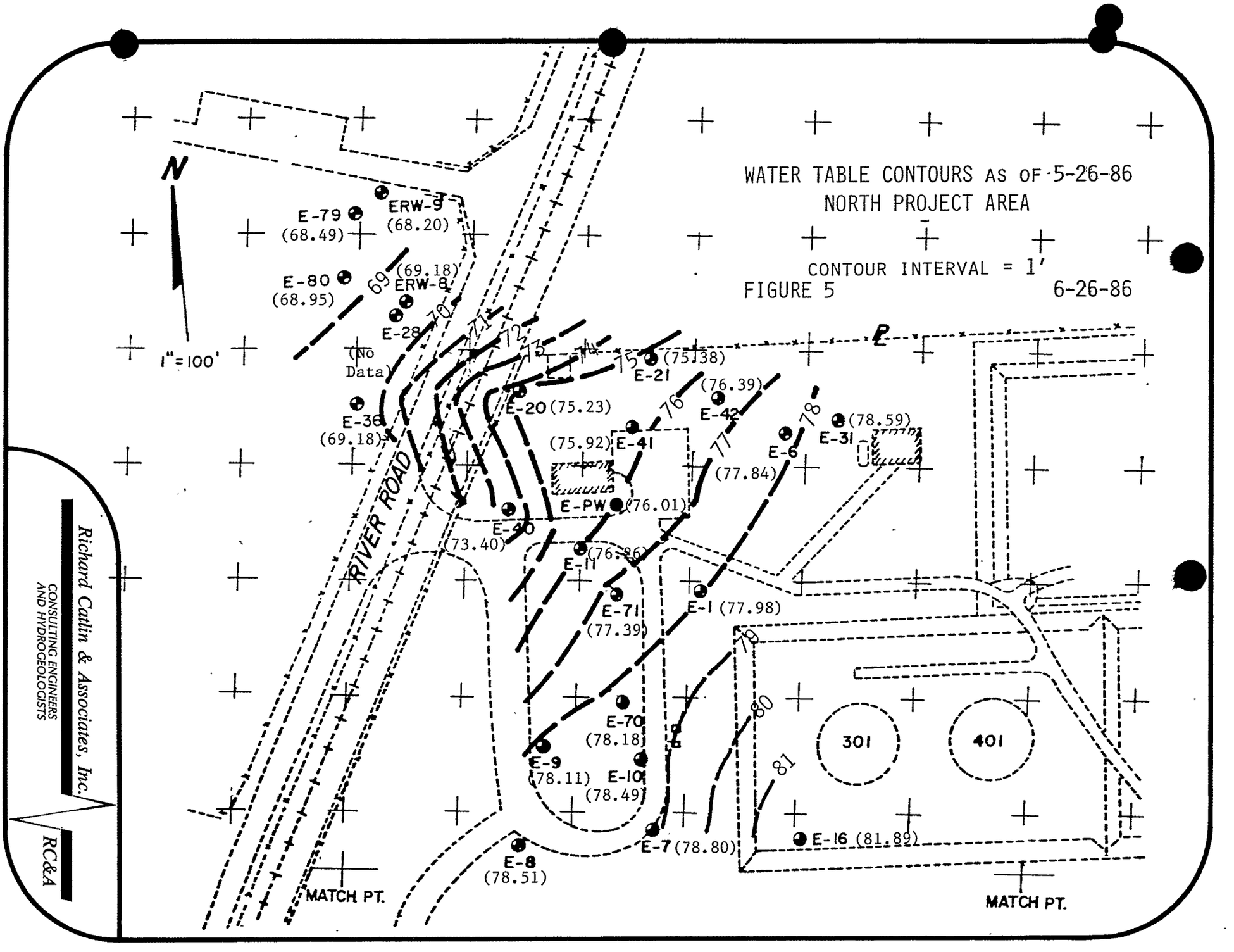


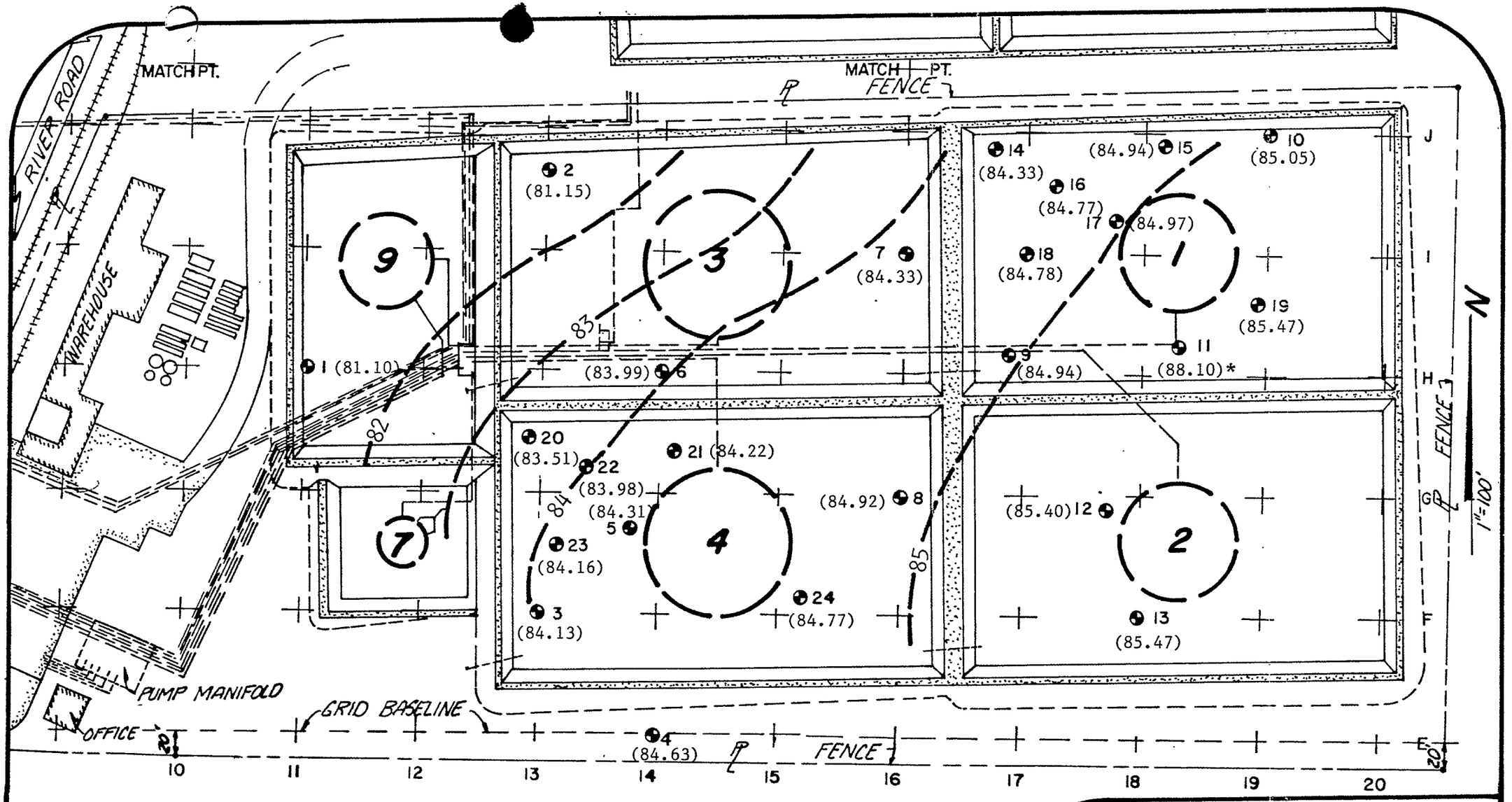
FIGURE 4A

HYDROGEOLOGIC CROSS SECTION A - A'
LOCATION MAP
6/24/86

KOCH FUELS, INC.
WILMINGTON, N.C.

RICHARD CATLIN & ASSOCIATES, INC.


WATER TABLE CONTOURS AS OF 5-26-86
NORTH PROJECT AREA
CONTOUR INTERVAL = 1'
FIGURE 5
6-26-86
N
1"=100'
E-79 (68.49)
ERW-9 (68.20)
E-80 (68.95)
(69.18)
ERW-8
E-28 (No Data)
E-36 (69.18)
E-20 (75.23)
(75.38)
E-21
(76.39)
E-42
(78.59)
E-31
E-6
(75.92)
E-41
(77.84)
E-PW (76.01)
E-40 (73.40)
(76.86)
E-11
E-71 (77.39)
E-1 (77.98)
E-70 (78.18)
E-9 (78.11)
E-10 (78.49)
E-7 (78.80)
E-8 (78.51)
E-16 (81.89)
301
401
RIVER ROAD
MATCH PT.
MATCH PT.
69
70
71
72
73
74
75
76
77
78
79
80
81
Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A

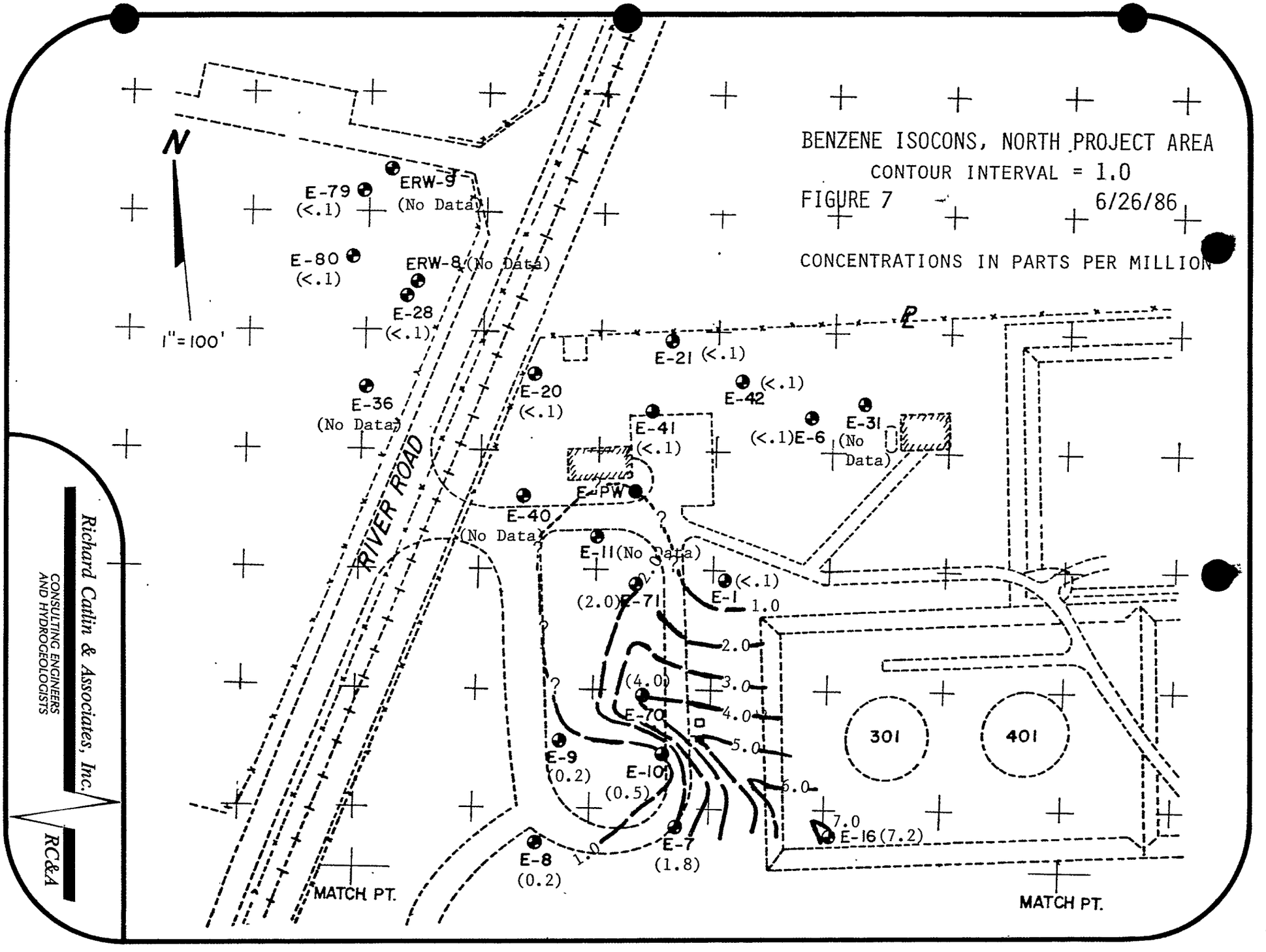


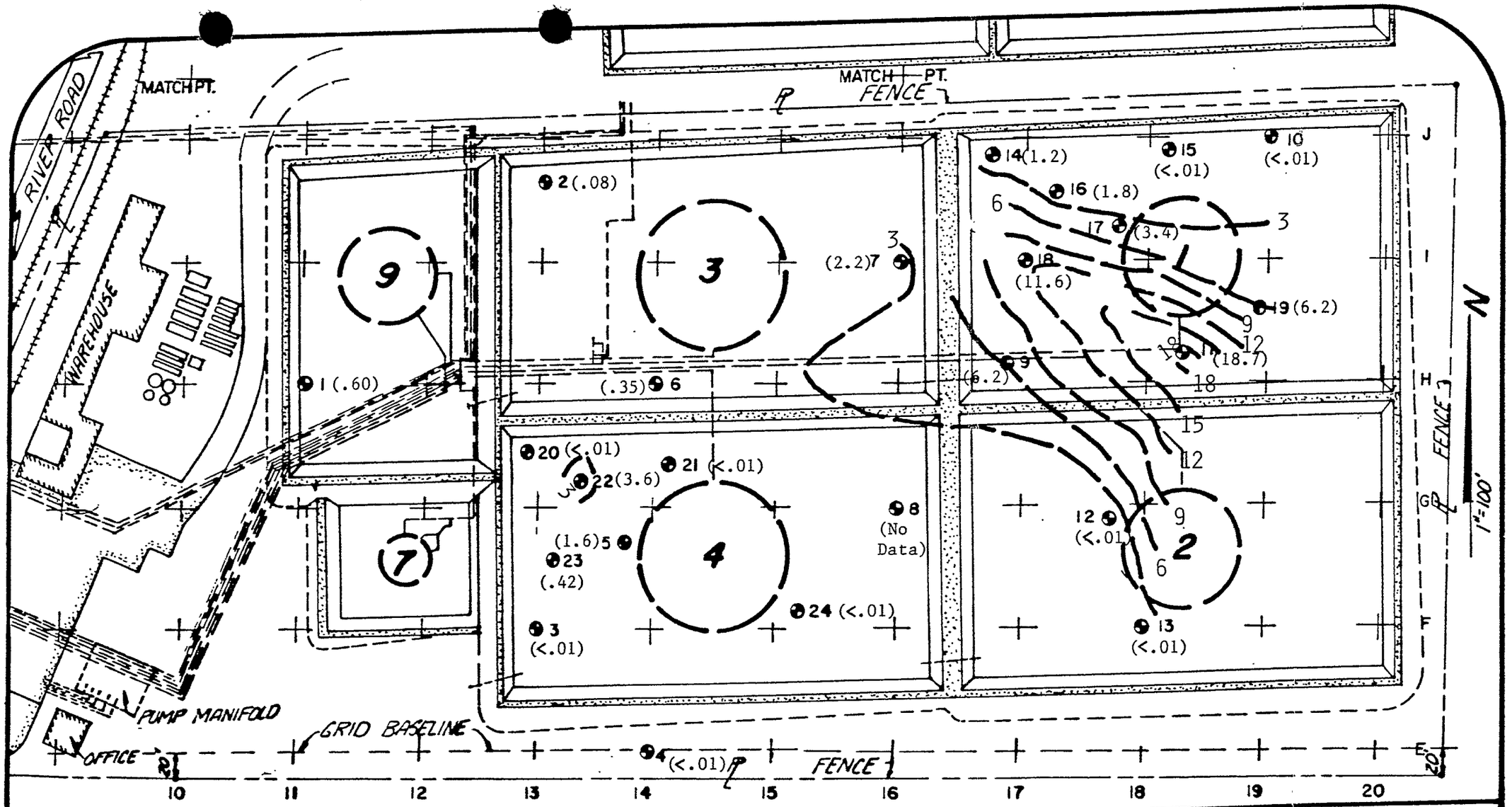
*DATA UNRELIABLE DUE TO MISCIBLE PRODUCT EFFECTS

WATER TABLE CONTOURS AS OF 5-26-86
SOUTH PROJECT AREA
CONTOUR INTERVAL = 1
FIGURE 6 6-26-86

KOCH FUELS, INC.
WILMINGTON, N.C.

RICHARD CATLIN & ASSOCIATES, INC.


BENZENE ISOCONS, NORTH PROJECT AREA
CONTOUR INTERVAL = 1.0
FIGURE 7
6/26/86
CONCENTRATIONS IN PARTS PER MILLION
N
1"=100'
E-79 (<.1)
ERW-9 (No Data)
E-80 (<.1)
ERW-8 (No Data)
E-28 (<.1)
E-21 (<.1)
E-42 (<.1)
E-36 (No Data)
E-20 (<.1)
E-41 (<.1)
E-6 (<.1)
E-31 (No Data)
E-PW
E-40 (No Data)
E-11 (No Data)
RIVER ROAD
(2.0) E-71
E-1 (<.1)
1.0
2.0
3.0
4.0
5.0
6.0
7.0
(4.0)
E-70
E-9 (0.2)
E-10 (0.5)
E-7 (1.8)
E-8 (0.2)
E-16 (7.2)
301
401
MATCH PT.
MATCH PT.
Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A

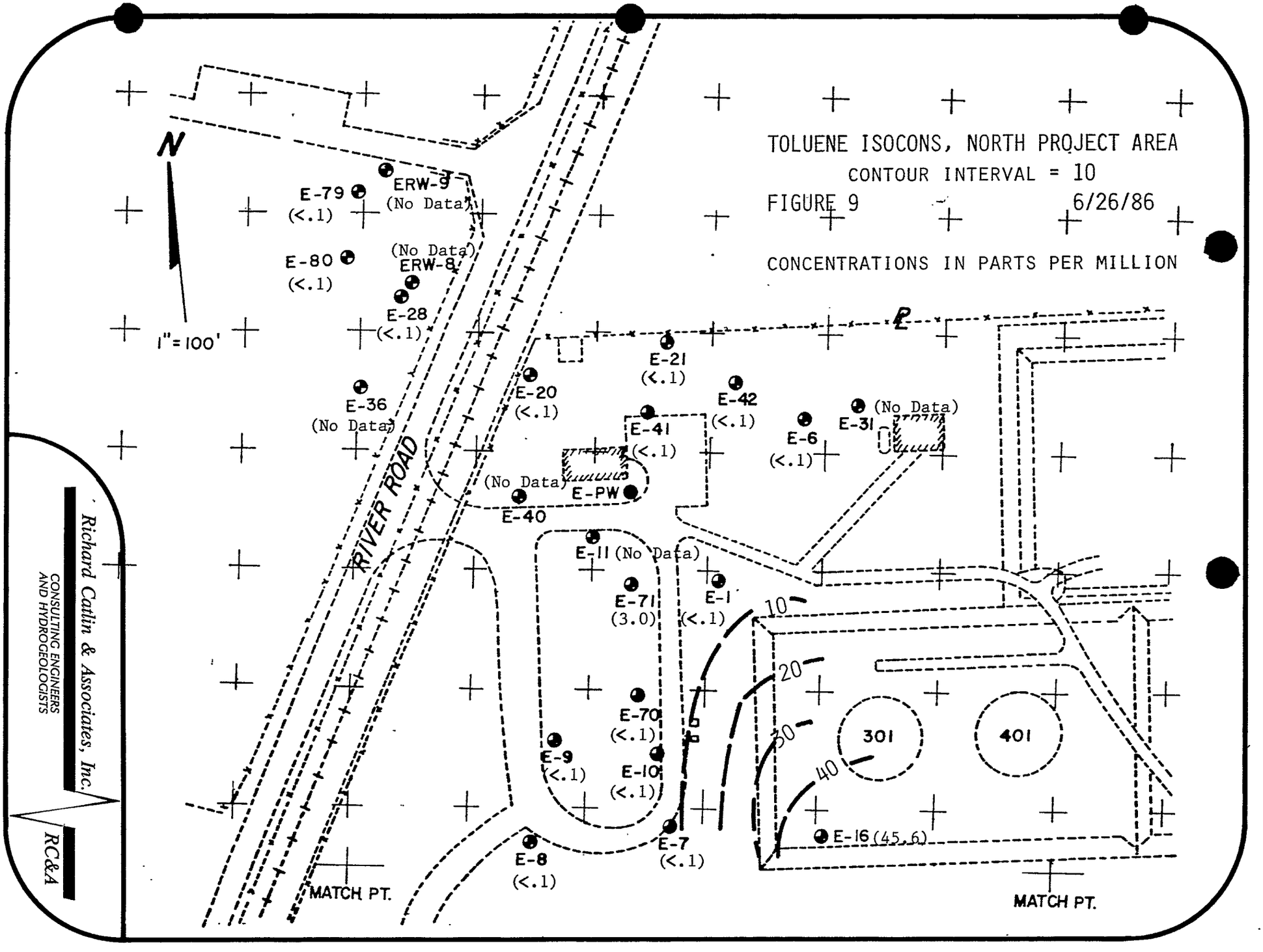


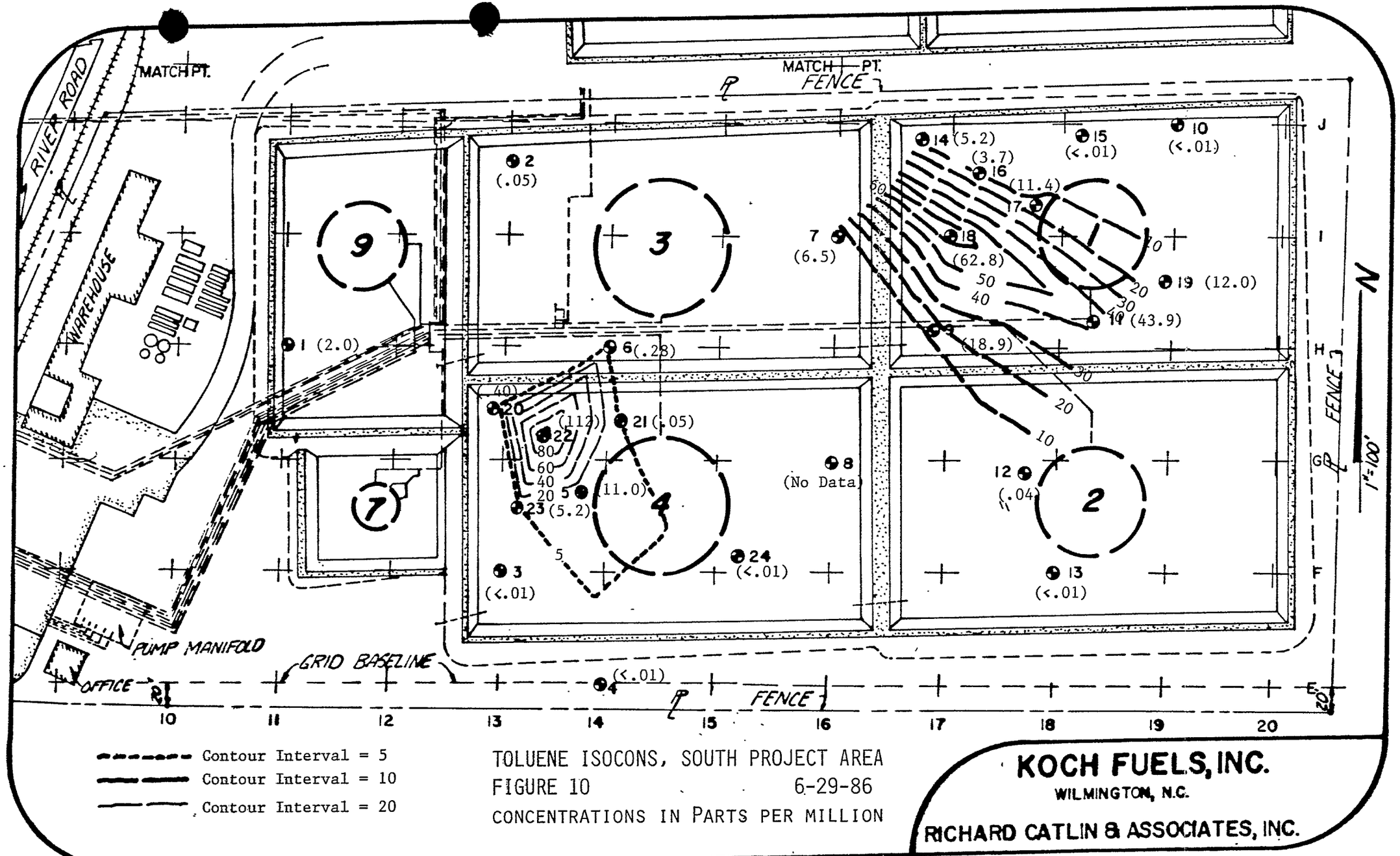
CONCENTRATIONS IN PARTS PER MILLION

BENZENE ISOCONS, SOUTH PROJECT AREA
FIGURE 8 6/27/86
CONTOUR INTERVAL = 3

KOCH FUELS, INC.
WILMINGTON, N.C.

RICHARD CATLIN & ASSOCIATES, INC.

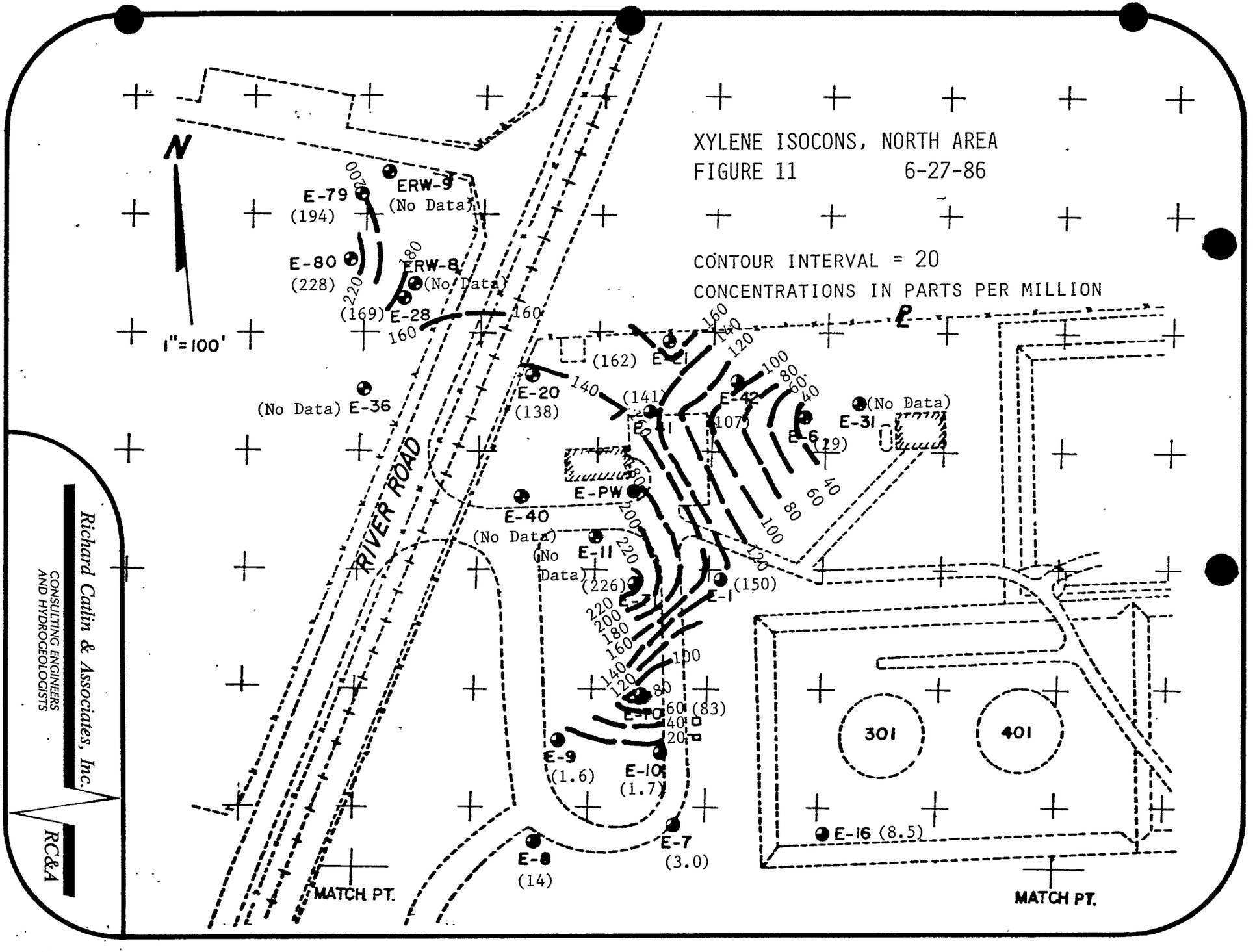

TOLUENE ISOCONS, NORTH PROJECT AREA
CONTOUR INTERVAL = 10
FIGURE 9
6/26/86
CONCENTRATIONS IN PARTS PER MILLION
N
1"=100'
E-79 (<.1)
ERW-9 (No Data)
E-80 (<.1)
(No Data) ERW-8
E-28 (<.1)
E-36 (No Data)
E-20 (<.1)
E-21 (<.1)
E-42 (<.1)
E-41 (<.1)
E-6 (<.1)
E-31 (No Data)
(No Data) E-PW
E-40
RIVER ROAD
E-11 (No Data)
E-71 (3.0)
E-1 (<.1)
10
20
30
40
E-70 (<.1)
E-9 (<.1)
E-10 (<.1)
E-7 (<.1)
E-8 (<.1)
301
401
E-16 (45.6)
MATCH PT.
MATCH PT.
Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A

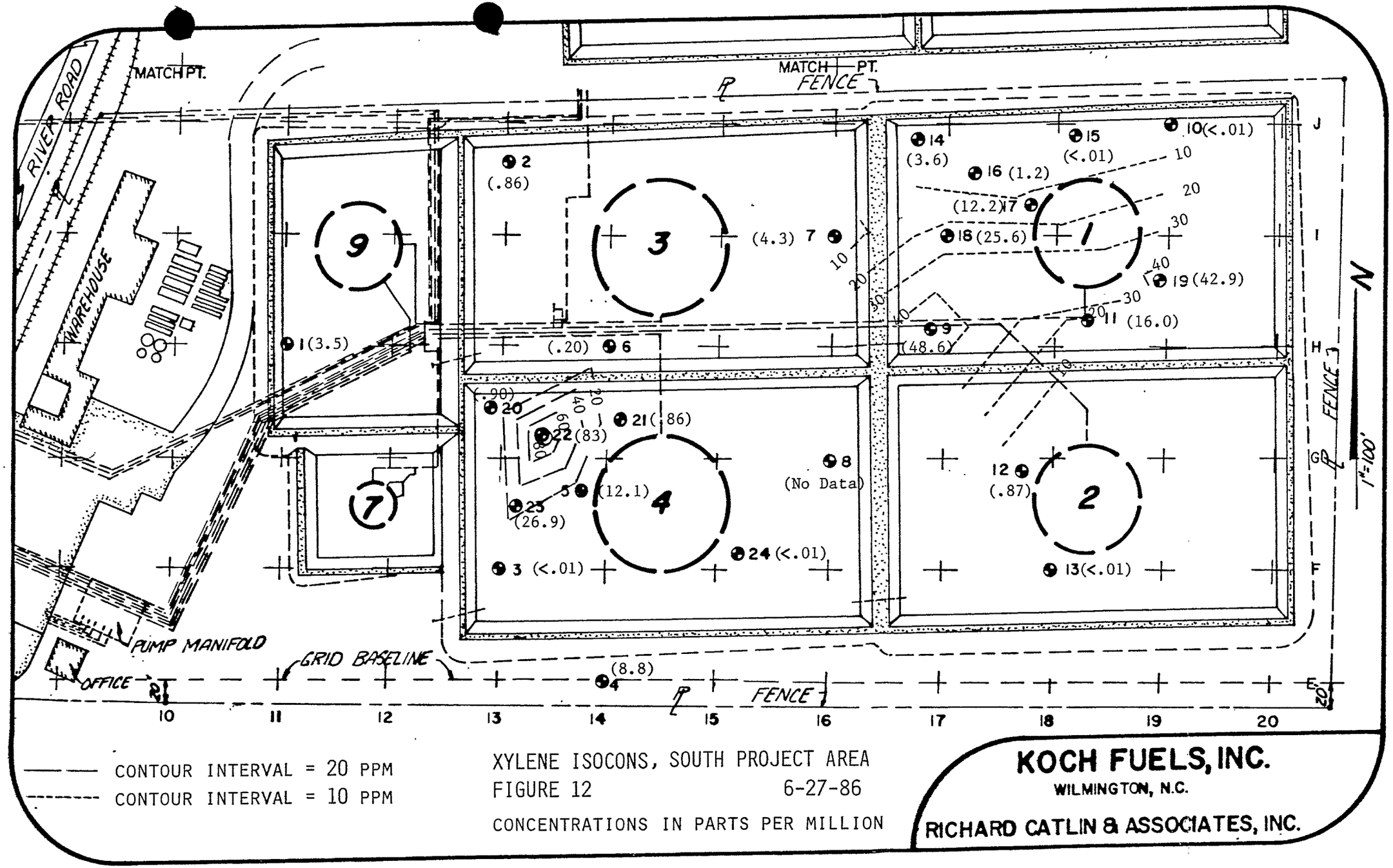


Contour Interval = 5
Contour Interval = 10
Contour Interval = 20

TOLUENE ISOCONS, SOUTH PROJECT AREA
FIGURE 10 6-29-86
CONCENTRATIONS IN PARTS PER MILLION

KOCH FUELS, INC.
WILMINGTON, N.C.
RICHARD CATLIN & ASSOCIATES, INC.


XYLENE ISOCONS, NORTH AREA
FIGURE 11 6-27-86
CONTOUR INTERVAL = 20
CONCENTRATIONS IN PARTS PER MILLION
N
1"=100'
E-79 (194)
ERW-9 (No Data)
E-80 (228)
ERW-8 (No Data)
(169) E-28
E-36 (No Data)
E-20 (138)
(162) E-21
(141)
E-42 (107)
E-6 (29)
E-31 (No Data)
E-PW
E-40 (No Data)
E-11 (No Data)
(226)
E-1 (150)
(83)
E-9 (1.6)
E-10 (1.7)
E-8 (14)
E-7 (3.0)
E-16 (8.5)
RIVER ROAD
MATCH PT.
MATCH PT.
301
401
Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A



—— —— CONTOUR INTERVAL = 20 PPM

-------- CONTOUR INTERVAL = 10 PPM

XYLENE ISOCONS, SOUTH PROJECT AREA

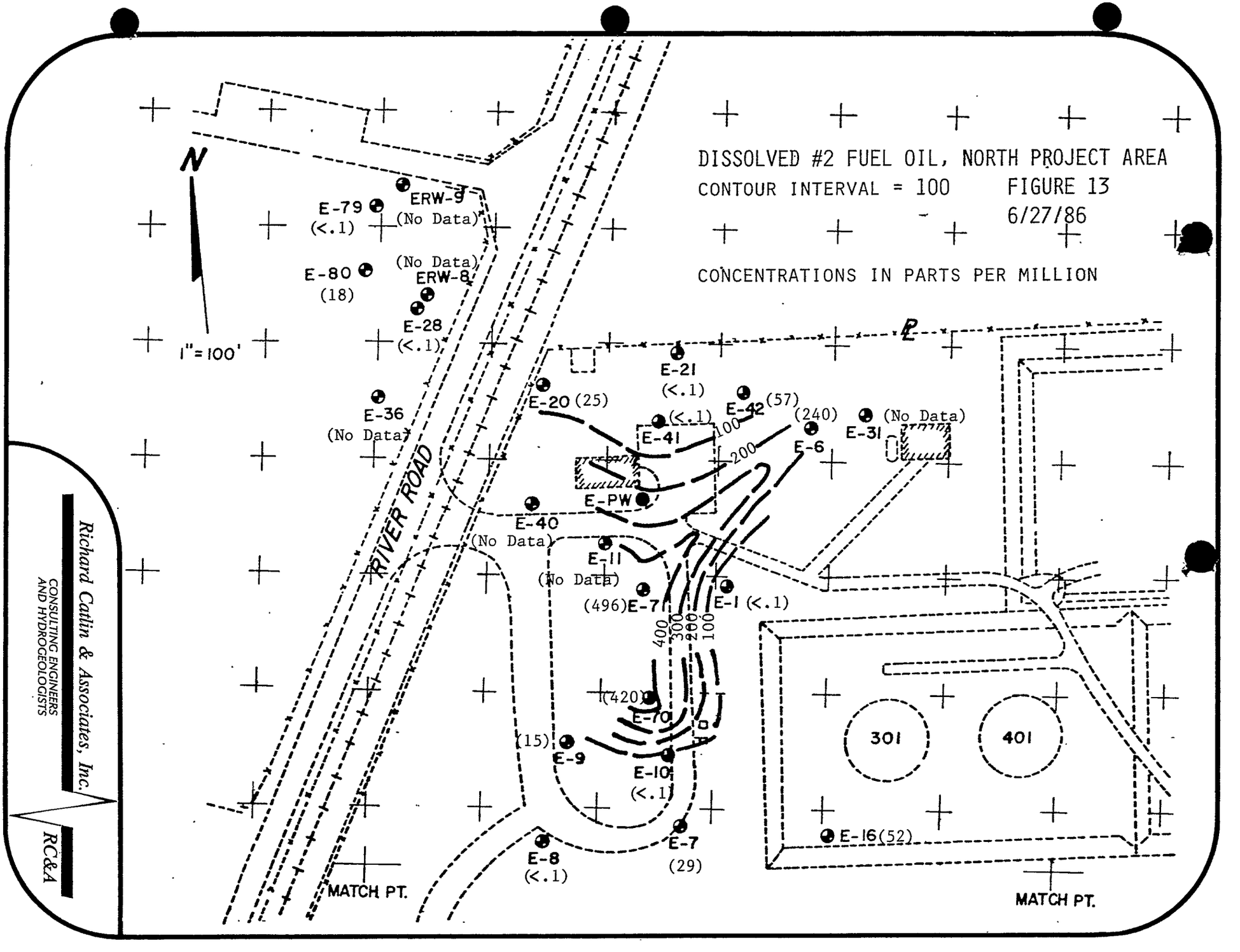
FIGURE 12 6-27-86

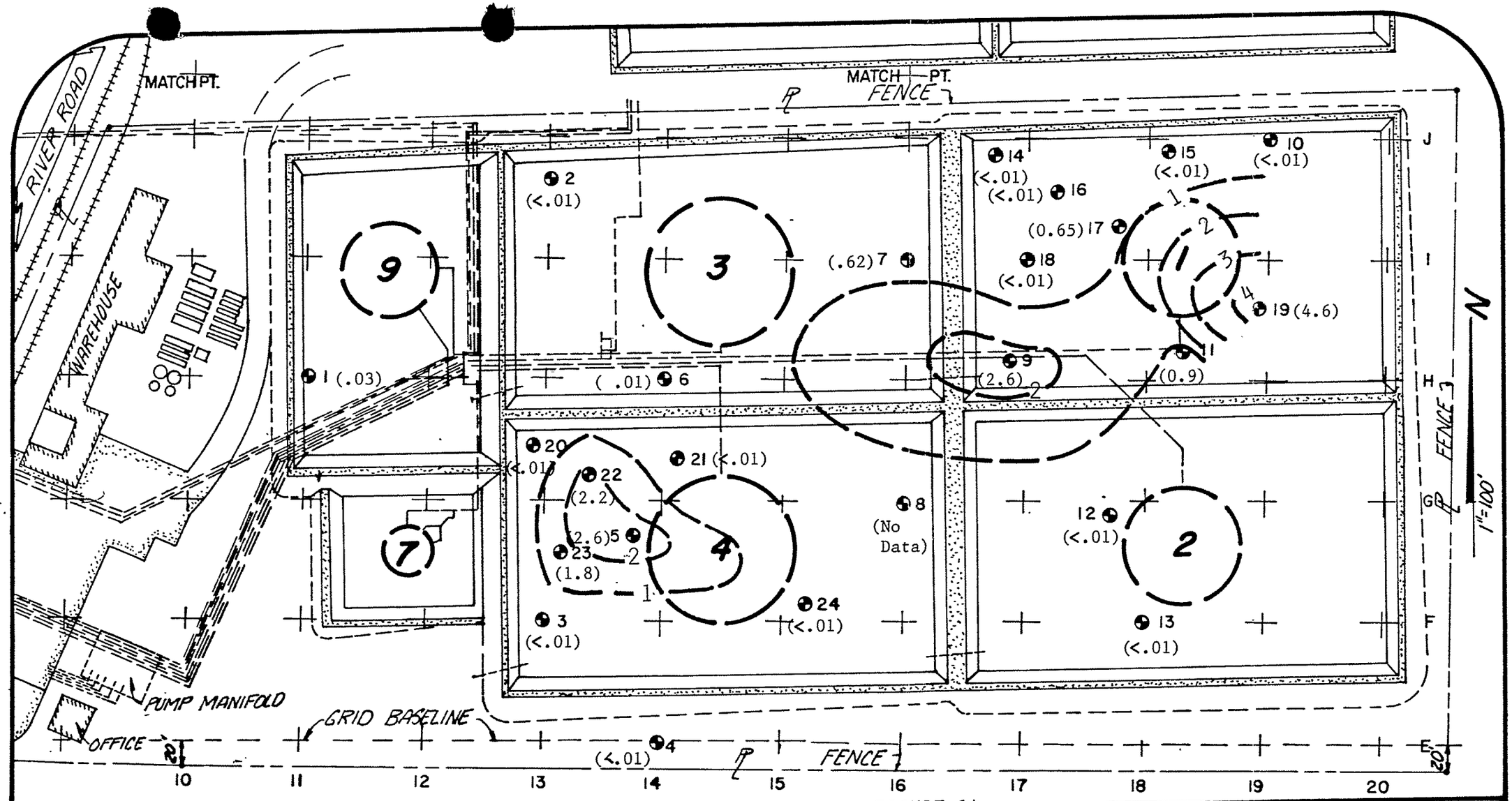
CONCENTRATIONS IN PARTS PER MILLION

KOCH FUELS, INC.

WILMINGTON, N.C.

RICHARD CATLIN & ASSOCIATES, INC.


DISSOLVED #2 FUEL OIL, NORTH PROJECT AREA
CONTOUR INTERVAL = 100
FIGURE 13
6/27/86
CONCENTRATIONS IN PARTS PER MILLION
N
1"=100'
ERW-9
E-79 (<.1)
(No Data)
E-80 (18)
(No Data)
ERW-8
E-28 (<.1)
E-21 (<.1)
E-20 (25)
E-36 (No Data)
E-41 (<.1)
E-42 (57)
(240)
E-6
E-31 (No Data)
100
200
E-PW
E-40 (No Data)
E-11 (No Data)
RIVER ROAD
(496) E-7
E-1 (<.1)
400
300
200
100
(420)
E-70
(15) E-9
E-10 (<.1)
E-8 (<.1)
E-7 (29)
E-16 (52)
301
401
MATCH PT.
MATCH PT.
Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A



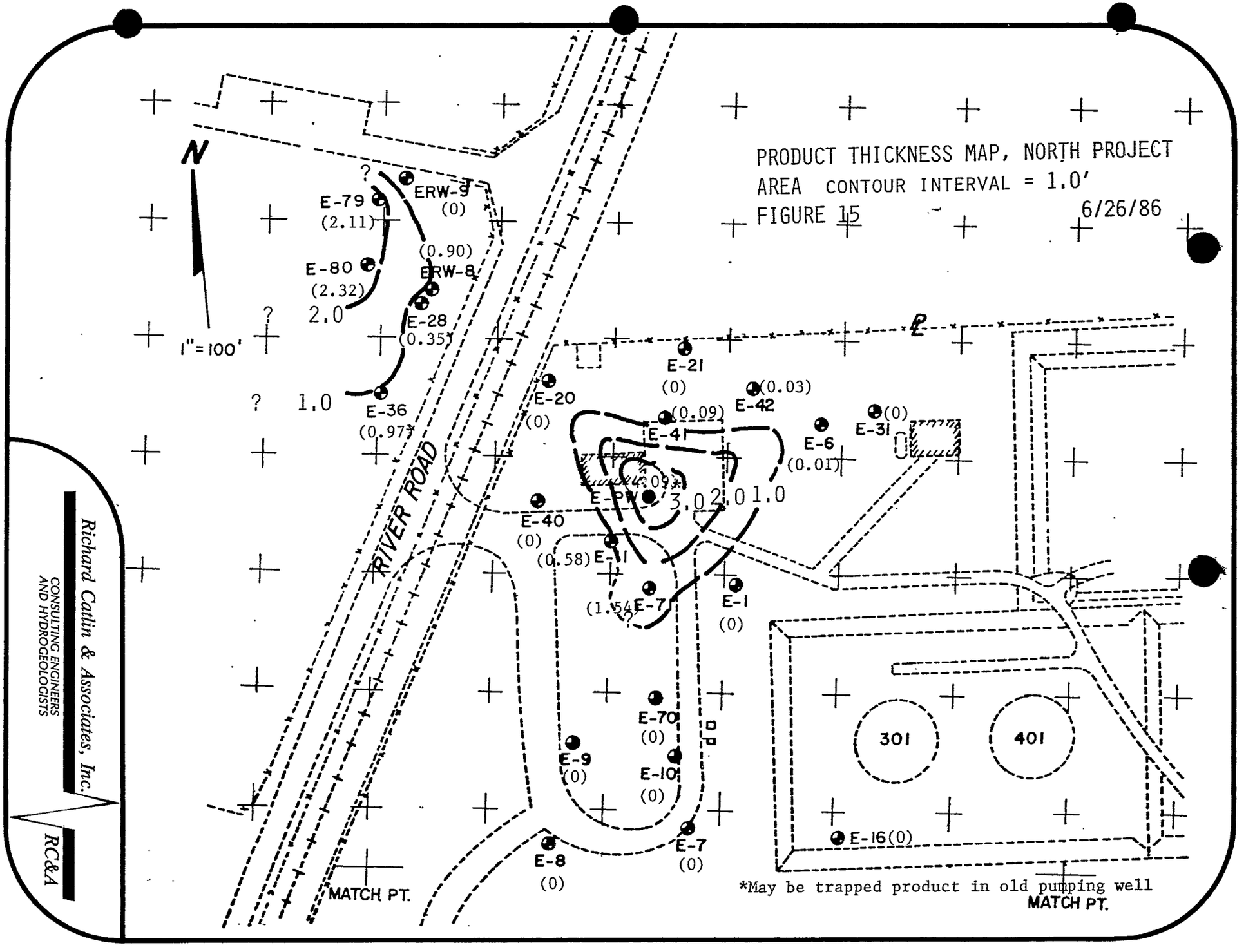
Concentrations in Parts Per Million

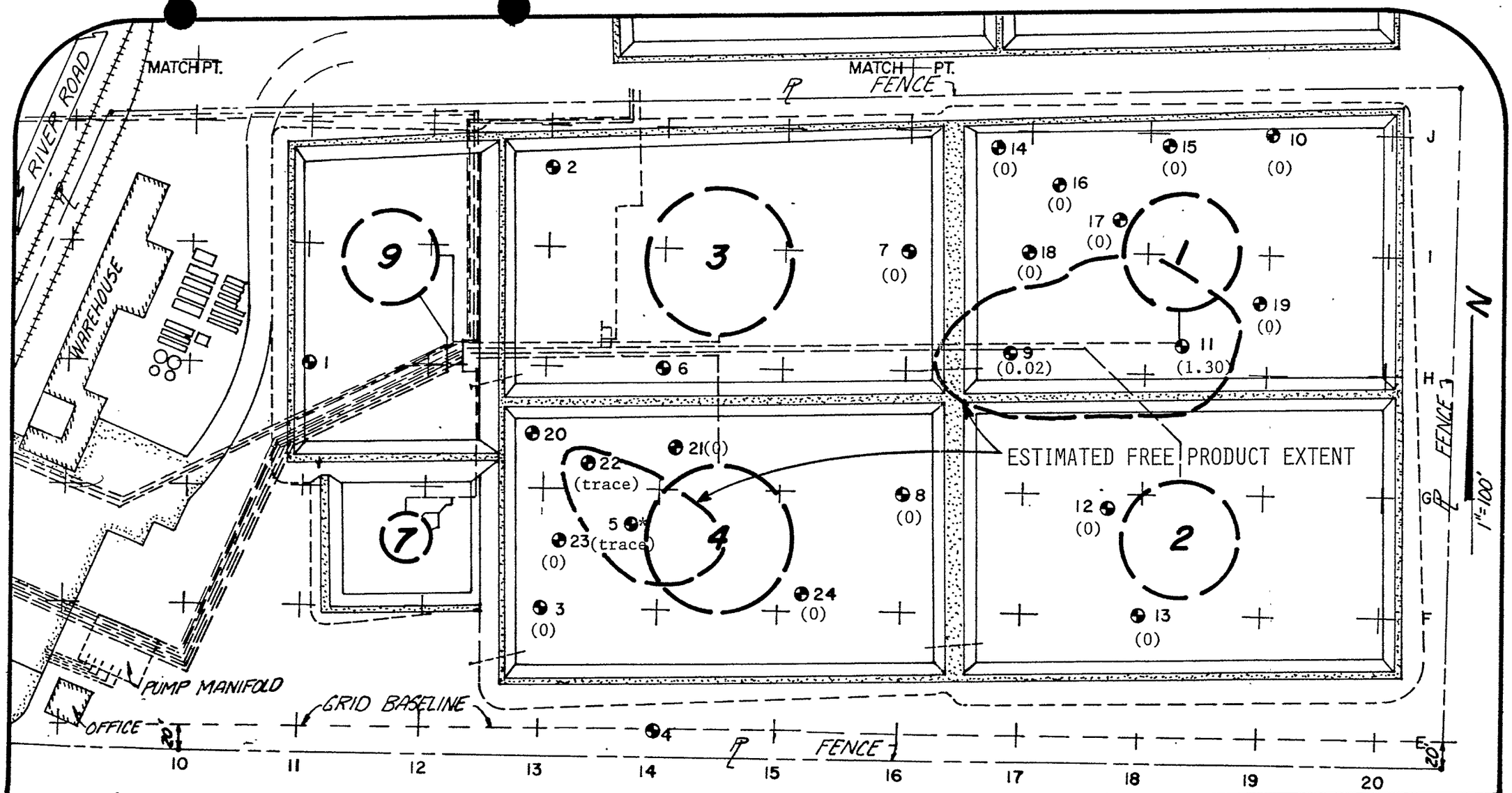
FIGURE 14

SOUTH PROJECT AREA
DISSOLVED #2 FUEL OIL/DIESEL
CONTOUR INTERVAL = 1.0
6/25/86

KOCH FUELS, INC.
WILMINGTON, N.C.

RICHARD CATLIN & ASSOCIATES, INC.


PRODUCT THICKNESS MAP, NORTH PROJECT AREA CONTOUR INTERVAL = 1.0'
FIGURE 15
6/26/86
N
1"=100'
RIVER ROAD
E-79 (2.11)
ERW-9 (0)
E-80 (2.32)
ERW-8 (0.90)
E-28 (0.35)
E-36 (0.97)
2.0
1.0
E-21 (0)
E-20 (0)
E-42 (0.03)
(0.09)
E-41
E-6 (0.01)
E-31 (0)
E-PW (4.09)
3.0
2.0
1.0
E-40 (0)
E-11 (0.58)
E-7 (1.54)
E-1 (0)
E-70 (0)
E-9 (0)
E-10 (0)
E-8 (0)
E-7 (0)
E-16 (0)
301
401
MATCH PT.
MATCH PT.
*May be trapped product in old pumping well
Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A



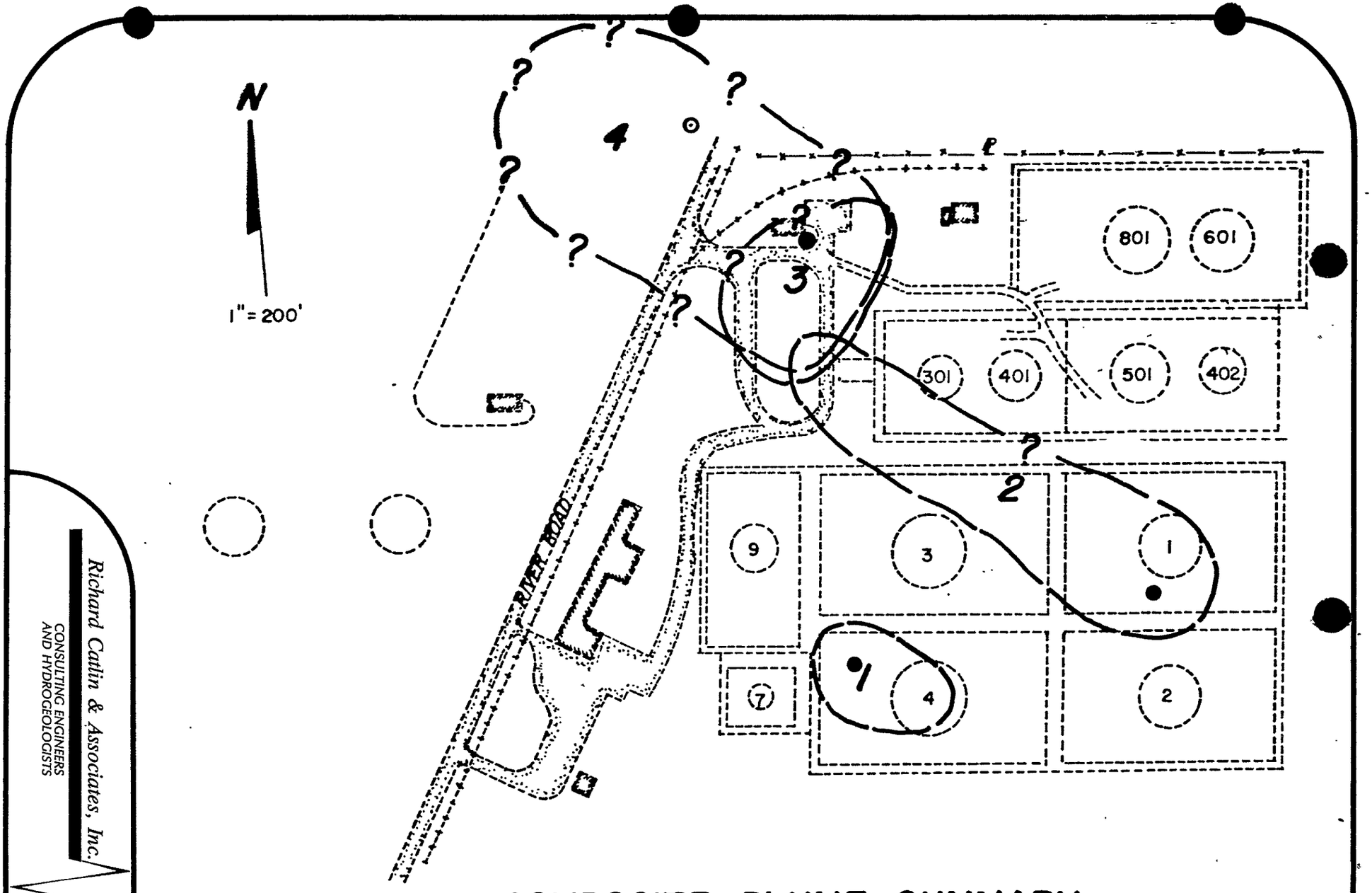
*OBSERVED 1.04' 2/28/86

ESTIMATED FREE PRODUCT PLUME AREAS
SOUTH PROJECT AREA AS OF 5/26/86

FIGURE 16 6/28/86

KOCH FUELS, INC.
WILMINGTON, N.C.

RICHARD CATLIN & ASSOCIATES, INC.



Richard Catlin & Associates, Inc.
CONSULTING ENGINEERS AND HYDROGEOLOGISTS
RC&A

FIGURE 17: **COMPOSITE PLUME SUMMARY** 5-23-86

⊙ EXISTING RECOVERY WELL ERW-8

● PROPOSED RECOVERY WELL

APPENDIX

B14

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH, N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728
STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC.
(Road, Community, or Subdivision and Lot No.)
County: NEW HANOVER
OWNER KOCH FUELS, INC.
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-16-86 USE OF WELL MONITOR
TOTAL DEPTH 20' SPTS CUTTINGS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 15.37 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 1.71 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 15.66
CHLORINATION: Type — Amount —

Depth From	Depth To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 5	Ft.	2"	SCH40	PVC
From _____	To _____	Ft.			
From _____	To _____	Ft.			

GROUT:

	Depth		Material	Method
From 0	To 3	Ft.	NEAT	IN-PLACE
From _____	To _____	Ft.		

SCREEN:

	Depth		Diameter	Slot Size	Material
From 5	To 20	Ft.	2" in.	.015 in.	PVC
From _____	To _____	Ft.	in.	in.	
From _____	To _____	Ft.	in.	in.	

GRAVEL PACK:

	Depth		Size	Material
From 4	To 20	Ft.	MEDIUM	SAND
From _____	To _____	Ft.		

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
ATTACHED

REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 6-2-86

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

246 Two [illegible] Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT Koch Fuels, Inc.

CD PROJECT # 86-330 BORING # B14 DATE 5-16-86

CLIENT PROJECT # 64-0315-WM-0212 SURFACE ELEVATION _____

DRILLER G. Bridger CREW R. Fowler

DEPTH FROM	DEPTH TO	SOIL STRATA / SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	17	VERY Loose TO FIRM TAN AND DARK GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	1	2	2	
			SP	2	8.5	10	1	3	4	
17	20	Loose DARK BROWN FINE SAND- SOME ORGANICS, WET	SP	3	13.5	15	3	8	9	
			SM	4	18.5	20	1	1	7	

NON-DRILLING TIME (Hrs.) _____

BORING LAYOUT _____ MOVING _____

CLEARING _____ STANDBY _____

WATER LEVEL: @ _____ DATE _____ TIME _____

@ _____ DATE _____ TIME _____

CAVE-IN DEPTH: @ _____ DATE _____ TIME _____

REMARKS: _____

B15

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc ____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC.
(Road, Community, or Subdivision and Lot No.)
County: NEW HANOVER
OWNER KOCH FUELS, INC.
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28405
City or Town State Zip Code
DATE DRILLED 5-19-86 USE OF WELL MONITOR
TOTAL DEPTH 20 ~~CUTTINGS~~ SPLITS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 15.93 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.74 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 13, 19
CHLORINATION: Type — Amount —

CASING:

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	5 Ft.	2"	SCH 40	PVC
		Ft.			
		Ft.			

GROUT:

	Depth From	To	Material	Method
	0	3 Ft.	NEAT	IN-PLACE
		Ft.		

SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	5	20 Ft.	2 in.	.015 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

GRAVEL PACK:

	Depth From	To	Size	Material
	4	20 Ft.	MEDIUM	SAND
		Ft.		

REMARKS: _____

DRILLING LOG

Depth From	To	Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Craig R. Davis 6-2-86
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

TEST BORING FIELD REPORT

CAROLINA DRILLING
246 Two [illegible] Road
Wilmington, N.C. 28405
(919) 799-0493

CD PROJECT KOCH FUELS, INC

CD PROJECT # 86-338 BORING # B15 DATE 5-19-86

CLIENT PROJECT # 64-0315-WM-02/2 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA: SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	17	LOOSE TO FIRM TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	2	2	3	
			SP	2	8.5	10	2	2	4	
17	20	VERY LOOSE DARK BROWN FINE SAND - SOME SILT AND ORGANICS, WET	SP	3	13.5	15	8	10	11	
			SM	4	18.5	20	1/12"		1	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

B16

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728
STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)
County: NEW HANOVER
OWNER KOCH FUELS, INC
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-19-86 USE OF WELL MONITOR
TOTAL DEPTH 20 SPTS CUTTINGS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 15.56 FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 2.85 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 12-71
CHLORINATION: Type — Amount —

CASING:

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	5 Ft.	2"	SCH40	PVC
		Ft.			
		Ft.			

GROUT:

	Depth From	To	Material	Method
	0	3 Ft.	NEAT	IN-PLACE
		Ft.		

SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	5	20 Ft.	2 in.	.015 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

GRAVEL PACK:

	Depth From	To	Size	Material
	4	20 Ft.	MEDIUM	SAND
		Ft.		

REMARKS: _____

DRILLING LOG

Depth From	To	Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 6-2-86

GW-1 Revised 11/84
Submit original to Division of Environmental Management and copy to well owner.

TEST BORING FIELD REPORT

CAROLINA DRILLING
246 Two [illegible] Road
Wilmington, N.C. 28405
(919) 799-0493

CD PROJECT Koch Foods, INC.

CD PROJECT # 86-338 BORING # B16 DATE 5-19-86

CLIENT PROJECT # 64-0315-4m-0212 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA: SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	17	LOOSE TO FIRM TAN AND DARK GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	1	3	3	
			SP	2	8.5	10	2	4	5	
17	20	VERY LOOSE DARK BROWN FINE SAND- SOME ORGANICS AND SILT, WET	SP	3	13.5	15	4	7	8	
			SM	4	18.5	20	1/12"		1	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

B17

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728
STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)
OWNER KOCH FUELS, INC
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-16-86 USE OF WELL MONITOR
TOTAL DEPTH 20 CUTTINGS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 14.39 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.10 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 12.29
CHLORINATION: Type — Amount —
CASING:

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	5 Ft.	2"	SCH40	PVC
		Ft.			
		Ft.			

GROUT:

	Depth From	To	Material	Method
	0	3 Ft.	NEAT	IN-PLACE
		Ft.		

SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	5	20 Ft.	2 in.	.015 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

GRAVEL PACK:

	Depth From	To	Size	Material
	4	20 Ft.	MEDIUM	SAND
		Ft.		

REMARKS: _____

County: NEW HANOVER

Depth From	To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 6-2-86

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

TEST BORING FIELD REPORT

CAROLINA DRILLING
246 Two [illegible] Road
Wilmington, N.C. 28405
(919) 799-0493

CD PROJECT Koch F[illegible]ls, INC

CD PROJECT # 86-338 BORING # B17 DATE 5-16-86

CLIENT PROJECT # 64-03IS-WM-021 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	17	LOOSE TO FIRM TAN AND DARK GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	3	4	5	
			SP	2	8.5	10	4	3	4	
17	20	VERY LOOSE DARK BROWN FINE SAND - SOME ORGANICS AND SILT, WET	SM	3	13.5	15	4	8	11	
			SM	4	18.5	20	2	2	2	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

B18

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

RILLING CONTRACTOR CAROLINA DRILLING
RILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)
OWNER KOCH FUELS, INC.
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-16-86 USE OF WELL MONITOR
TOTAL DEPTH 20 ~~CUTTINGS~~ SPLS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 13.83 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 1.60 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 12, 23

CHLORINATION: Type — Amount —

CASING:

	Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
	0	5		2	SCH40	PVC

GROUT:

	Depth From	To	Ft.	Material	Method
	0	3		NEAT	IN-PLACE

SCREEN:

	Depth From	To	Ft.	Diameter	Slot Size	Material
	5	20		2 in.	.015 in.	PVC
				in.	in.	
				in.	in.	

GRAVEL PACK:

	Depth From	To	Ft.	Size	Material
	4	20		MEDIUM	SAND

REMARKS: _____

County: NEW HANOVER

Depth From	To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Jeff K. Baker 6-2-86
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

TEST BORING FIELD REPORT

CD CAROLINA DRILLING
246 Two C[illegible] Road
Wilmington, N.C. 28405
(919) 799-0493

CD PROJECT Koch Fu[illegible]s, INC

CD PROJECT # 86-338 BORING # B18 DATE 5-16-86

CLIENT PROJECT # 64-0315-WM-021Z SURFACE ELEVATION _____

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA: SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	20	LOOSE TO FIRM TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	1	2	3	
			SP	2	8.5	10	4	10	14	
			SP	3	13.5	15	4	6	10	
			SP	4	18.5	20	4	7	7	

NON-DRILLING TIME (Hrs.) _____

BORING LAYOUT _____ MOVING _____

CLEARING _____ STANDBY _____

WATER LEVEL: @ _____ DATE _____ TIME _____

@ _____ DATE _____ TIME _____

CAVE-IN DEPTH: @ _____ DATE _____ TIME _____

REMARKS: _____

1319

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY

Quad. No. ______ Serial No. ______
Lat. ______ Long. ______ Pc ______
Minor Basin ______
Basin Code ______
Header Ent. ______ GW-1 Ent. ______

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: CAROLINA DRILLING
DRILLER REGISTRATION NUMBER: 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)

Nearest Town: WILMINGTON
KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)

County: NEW HANOVER

OWNER: KOCH FUELS, INC

ADDRESS: ______
(Street or Route No.)

WILMINGTON NC 28401
City or Town / State / Zip Code

DATE DRILLED: 5-19-86 USE OF WELL: MONITOR

TOTAL DEPTH: 20 ~~CUTTINGS~~ SPT'S COLLECTED ☒ Yes ☐ No

DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No

STATIC WATER LEVEL: 15.88 FT. ☐ above ☒ below TOP OF CASING,

TOP OF CASING IS 2.56 FT. ABOVE LAND SURFACE.

YIELD (gpm): — METHOD OF TEST —

WATER ZONES (depth): 13.32

CHLORINATION: Type — Amount —

CASING:

Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
0	5 Ft.	2	SCH 40	PVC
	Ft.			
	Ft.			

GROUT:

Depth From	To	Material	Method
0	3 Ft.	NEAT	IN-PLACE
	Ft.		

SCREEN:

Depth From	To	Diameter	Slot Size	Material
5	20 Ft.	2 in.	.015 in.	PVC
	Ft.	in.	in.	
	Ft.	in.	in.	

GRAVEL PACK:

Depth From	To	Size	Material
4	20 Ft.	MEDIUM	SAND
	Ft.		

REMARKS: ______

DRILLING LOG

Depth From	To	Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 6-2-86
SIGNATURE OF CONTRACTOR OR AGENT — DATE

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

248 Two Chopt Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT KOCH FUELS, INC.

CD PROJECT # 86-338 BORING # B19 DATE 5-19-86

CLIENT PROJECT # 640315-WM-0212 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA: SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	17	VERY LOOSE TO FIRM DARK BROWN AND TAN FINE SAND, MOIST TO WET	SP	1	3.5	5	2	2	2	
			SP	2	8.5	10	3	3	4	
17	20	VERY LOOSE DARK BROWN FINE SAND-TRACE OF ORGANICS, WET	SP	3	13.5	15	5	12	14	
			SP-SM	4	18.5	20	1	1	2	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT _____ MOVING _____

CLEARING _____ STANDBY _____

WATER LEVEL: @ _____ DATE _____ TIME _____

@ _____ DATE _____ TIME _____

CAVE-IN DEPTH: @ _____ DATE _____ TIME _____

REMARKS:

NORTH CAROLINA DEPARTMENT OF N[illegible]AL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL [illegible]AGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

B20

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc ____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

RILLING CONTRACTOR CAROLINA DRILLING
RILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC.
(Road, Community, or Subdivision and Lot No.)
OWNER KOCH FUELS, INC.
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-15-86 USE OF WELL MONITOR
TOTAL DEPTH 21 SPT's CUTTINGS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 11.69 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.24 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 9.45
CHLORINATION: Type — Amount —

County: NEW HANOVER

Depth From	Depth To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From	0	To 6 Ft.	2"	SCH 40	PVC
From		To Ft.			
From		To Ft.			

GROUT:

	Depth		Material	Method
From	0	To 4 Ft.	NEAT	IN-PLACE
From		To Ft.		

SCREEN:

	Depth		Diameter	Slot Size	Material
From	6	To 21 Ft.	2 in.	.015 in.	PVC
From		To Ft.	in.	in.	
From		To Ft.	in.	in.	

GRAVEL PACK:

	Depth		Size	Material
From	5	To 21 Ft.	MEDIUM	SAND
From		To Ft.		

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
ATTACHED

REMARKS: _____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 6-2-86
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84
Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

246 Two [illegible] Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT Koch Foods, INC.

CD PROJECT # 86-338 BORING # B20 DATE 5-15-86

CLIENT PROJECT # 64-0315-WM-0212 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	12	LOOSE TO FIRM TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	1	3	3	
			SP	2	8.5	10	2	6	7	
12	17	VERY LOOSE DARK BROWN FINE SAND - SOME ORGANICS, WET	SM	3	13.5	15	1	1/18"		
17	20	LOOSE GRAY FINE SAND, WET	SP	4	18.5	20	2	3	4	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

B21

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc ____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

RILLING CONTRACTOR CAROLINA DRILLING

RILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)

Nearest Town: WILMINGTON

KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)

OWNER KOCH FUELS, INC

ADDRESS _____
(Street or Route No.)

WILMINGTON NC 28401
City or Town State Zip Code

DATE DRILLED 5-15-86 USE OF WELL MONITOR

TOTAL DEPTH 21 SOILS CUTTINGS COLLECTED ☒ Yes ☐ No

DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No

STATIC WATER LEVEL: 12.07 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.41 FT. ABOVE LAND SURFACE.

YIELD (gpm): _____ METHOD OF TEST —

WATER ZONES (depth): 9.66

CHLORINATION: Type — Amount —

CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From	0	To 6 Ft.	2	SCH 40	PVC
From		To Ft.			
From		To Ft.			

GROUT:

	Depth		Material	Method
From	0	To 4 Ft.	NEAT	IN-PLACE
From		To Ft.		

SCREEN:

	Depth		Diameter	Slot Size	Material
From	6	To 21 Ft.	2 in.	.015 in.	PVC
From		To Ft.	in.	in.	
From		To Ft.	in.	in.	

GRAVEL PACK:

	Depth		Size	Material
From	5	To 21 Ft.	MEDIUM	SAND
From		To Ft.		

REMARKS: _____

County: NEW HANOVER

Depth From	Depth To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

246 Two Chopt Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT Koch Fuels, INC.

CD PROJECT # 86-338 BORING # B21 DATE 5-15-86

CLIENT PROJECT # 64-0315-WM-0212 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. Fowler

DEPTH FROM	DEPTH TO	SOIL STRATA: SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	12	VERY LOOSE TO LOOSE TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	3	2	12	
			SP	2	6.5	10	3	3	3	
12	16	VERY LOOSE DARK BROWN FINE SAND - TRACE OF ORGANICS, WET	SP-SM	3	13.5	15	1	1	1	
16	20	FIRM GRAY FINE SAND, WET	SP	4	18.5	20	5	9	12	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

B22

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH, N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC.
(Road, Community, or Subdivision and Lot No.)
OWNER KOCH FUELS, INC
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-15-86 USE OF WELL MONITOR
TOTAL DEPTH 21.5 CUTTINGS COLLECTED ☒ Yes ☐ No SPT'S
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 11.29 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 3.06 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 8.23

CHLORINATION: Type — Amount —

CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From	0	To 6 Ft.	2	SCH40	PVC
From		To Ft.			
From		To Ft.			

GROUT:

	Depth		Material	Method
From	0	To 4 Ft.	NEAT	IN-PLACE
From		To Ft.		

SCREEN:

	Depth		Diameter	Slot Size	Material
From	6	To 21 Ft.	2 in.	.015 in.	PVC
From		To Ft.	in.	in.	
From		To Ft.	in.	in.	

GRAVEL PACK:

	Depth		Size	Material
From	5	To 21 Ft.	MEDIUM	SAND
From		To Ft.		

REMARKS: _____

County: NEW HANOVER

Depth From	Depth To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 6-2-86

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

246 Two [illegible]t Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT Koch Foods, INC.

CD PROJECT # 86-338 BORING # B22 DATE 5-15-86

CLIENT PROJECT # 64-0315-WM-0212 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA / SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	13	VERY LOOSE TO FIRM TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	1	2	2	
			SP	2	8.5	10	6	8	12	
13	18	LOOSE DARK BROWN FINE SAND- SOME SILT AND ORGANICS, WET	SM	3	13.5	15	1/12"	8		
18	20	FIRM GRAY FINE SAND, WET	SP	4	18.5	20	6	7	10	

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

B23

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc ____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)
County: NEW HANOVER
OWNER KOCH FUELS, INC
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code
DATE DRILLED 5-15-86 USE OF WELL MONITOR
TOTAL DEPTH 21 ~~CUTTINGS~~ SPLITS COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 10.29 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.29 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 8.00
CHLORINATION: Type — Amount —

CASING:

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	6 Ft.	2.	SCH40	PVC
		Ft.			
		Ft.			

GROUT:

	Depth From	To	Material	Method
	0	4 Ft.	NEAT	IN-PLACE
		Ft.		

SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	6	21 Ft.	2 in.	.015 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

GRAVEL PACK:

	Depth From	To	Size	Material
	5	21 Ft.	MEDIUM	SAND
		Ft.		

REMARKS: _____

Depth From	To	DRILLING LOG Formation Description
		ATTACHED

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

ATTACHED

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT — DATE 6-2-86

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

246 Two Chopt Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT Koch Fuels, Inc.

CD PROJECT # 86-338 BORING # B27 DATE 5-15-86

CLIENT PROJECT # 64-0315-WM-0212 SURFACE ELEVATION

DRILLER G. Bridger CREW R. Fowler

DEPTH FROM	DEPTH TO	SOIL STRATA — SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	12	VERY LOOSE TO FIRM TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	1	1	1	
			SP	2	8.5	10	4	6	7	
12	17	VERY LOOSE DARK BROWN FINE SAND- SOME SILT AND ORGANICS, WET	SM	3	13.5	15	1/18"			
			SP	4	18.5	20	3	5	7	
17	20	FIRM GRAY FINE SAND, WET								

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

B24

NORTH CAROLINA DEPARTMENT OF [illegible]URAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTA[illegible]NAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR CAROLINA DRILLING
DRILLER REGISTRATION NUMBER 728

STATE WELL CONSTRUCTION PERMIT NUMBER: 64-0315-WM-0212

WELL LOCATION: (Show sketch of the location below)
Nearest Town: WILMINGTON
KOCH FUELS, INC
(Road, Community, or Subdivision and Lot No.)
County: NEW HANOVER

OWNER KOCH FUELS, INC
ADDRESS _____ (Street or Route No.)
WILMINGTON NC 28401
City or Town State Zip Code

DATE DRILLED 5-16-86 USE OF WELL MONITOR
TOTAL DEPTH 20 ~~CUTTINGS~~ SP-S COLLECTED ☒ Yes ☐ No
DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
STATIC WATER LEVEL: 10.17 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 1.31 FT. ABOVE LAND SURFACE.
YIELD (gpm): — METHOD OF TEST —
WATER ZONES (depth): 8.86

CHLORINATION: Type — Amount —

CASING:

	Depth From	To		Diameter	Wall Thickness or Weight/Ft.	Material
	0	5	Ft.	2"	SCH40	PVC
			Ft.			
			Ft.			

GROUT:

	Depth From	To		Material	Method
	0	3	Ft.	NEAT	IN-PLACE
			Ft.		

SCREEN:

	Depth From	To		Diameter		Slot Size		Material
	5	20	Ft.	2	in.	.015	in.	PVC
			Ft.		in.		in.	
			Ft.		in.		in.	

GRAVEL PACK:

	Depth From	To		Size	Material
	4	20	Ft.	MEDIUM	SAND
			Ft.		

REMARKS: _____

Depth From	To	DRILLING LOG Formation Description

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 6-2-86
SIGNATURE OF CONTRACTOR OR AGENT DATE

N-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

CAROLINA DRILLING

246 Two Chopt Road
Wilmington, N.C. 28405
(919) 799-0493

TEST BORING FIELD REPORT

CD PROJECT KOCH FUELS, INC.

CD PROJECT # 86-338 BORING # B24 DATE 5-16-86

CLIENT PROJECT # 64-0315-WM-0212 SURFACE ELEVATION

DRILLER G. BRIDGER CREW R. FOWLER

DEPTH FROM	DEPTH TO	SOIL STRATA: SOIL DESCRIPTION AND REMARKS	USCS	NO.	DEPTH FROM	DEPTH TO	FIRST 6"	2ND 6"	3RD 6"	REC.
0	12	LOOSE TAN AND GRAY FINE SAND, MOIST TO WET	SP	1	3.5	5	2	5	5	
			SP	2	8.5	10	3	3	3	
12	17	VERY LOOSE DARK BROWN FINE SAND- SOME SILT AND ORGANICS, WET	SM	3	13.5	15	1	1/18"		
			SP	4	18.5	20	3	4	3	
17	20	LOOSE GRAY FINE SAND, WET								

NON-DRILLING TIME (Hrs.)

BORING LAYOUT MOVING

CLEARING STANDBY

WATER LEVEL: @ DATE TIME

@ DATE TIME

CAVE-IN DEPTH: @ DATE TIME

REMARKS:

JOB: PUMP TEST COMPUTED BY: R. CATLIN DATE: 6/29/86

DESCRIPTION: KOCH FUELS CHECKED BY: _____ DATE: _____

PUMPING WELL = WELL B-5

OBSERVATION WELL = B-22

$r = 60'$

EST. $M = 40'$ $r = 1.5\,M$ ASSUME NO PARTIAL PENETRATION EFFECTS.

DATA

TIME (DAYS)	DRAWDOWN (FT.)
6.9^{-3}	-.01
1.7^{-2}	.03
3.3^{-2}	.04
5.7^{-2}	.05
1.2^{-1}	.07
1.8^{-1}	.07
2.3^{-1}	.12

Q (AVG) = 8.5 GPM = 12,240 GPD

MATCH PT. DATA: $1/u_A = 1$

$W(u_A, r/D) = 1$

$\Delta = .055$

$t = 2.5 \times 10^{-2}$

$r/D = 2.0$

$$T = \frac{Q\,W(u_A, r/D)}{4\pi\Delta}$$

$= 12,718$ GPD/FT

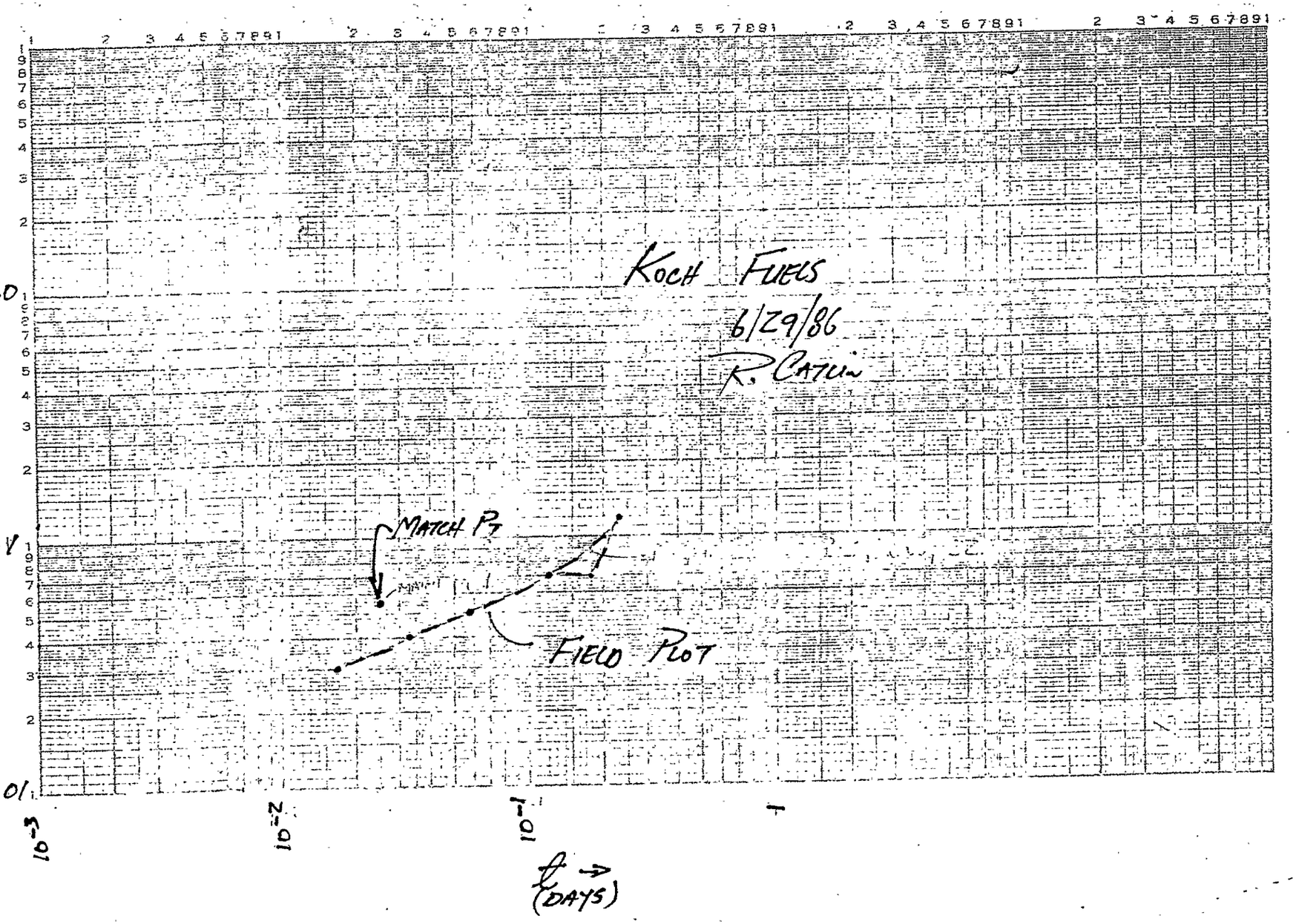
$K = T/m = 442$ GPD/FT^2

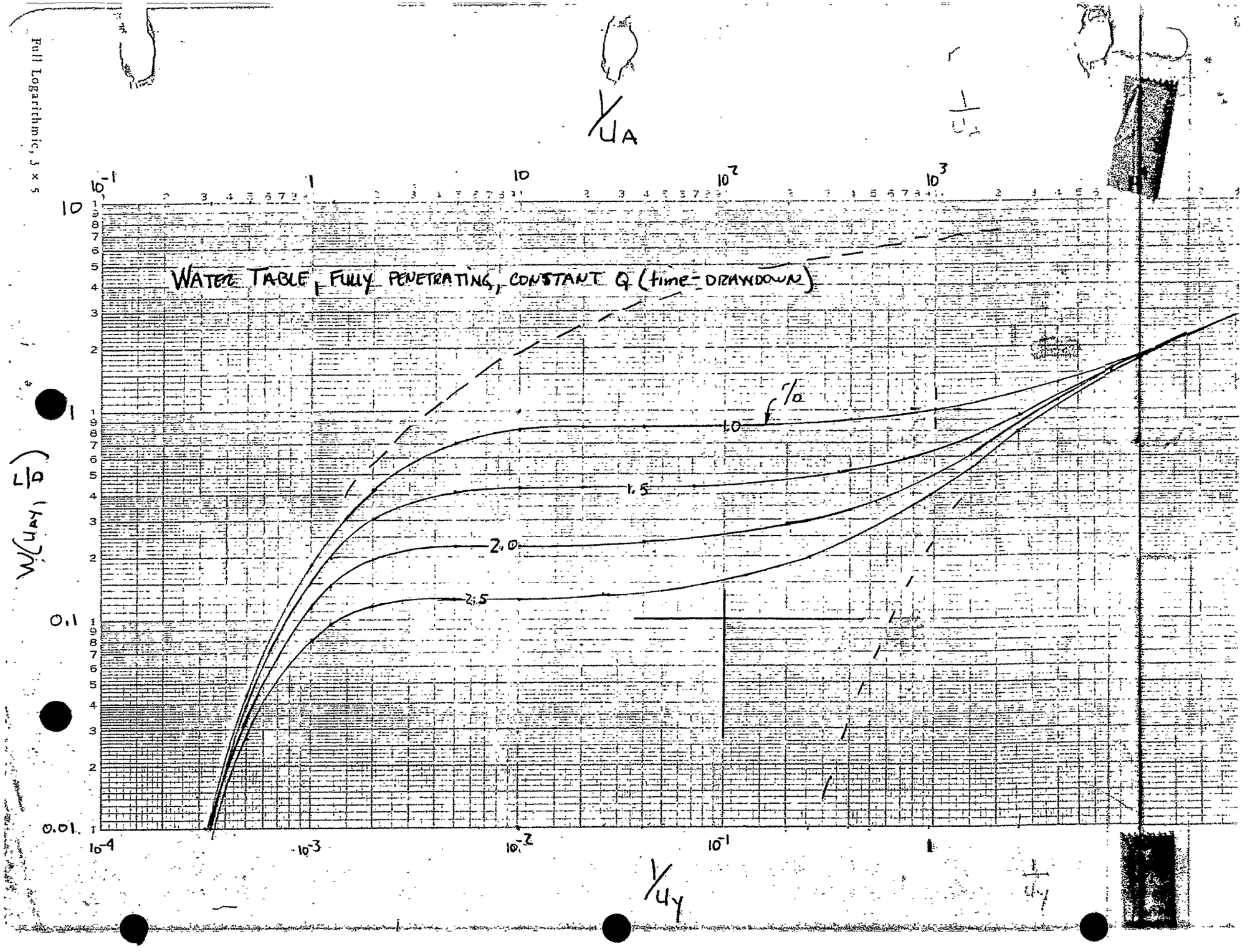
SAY 400

$S \simeq 1\% \pm$

$V = KS$

$V \sim 4$ FPD


KOCH FUELS
6/29/86
R. CATLIN
MATCH PT
FIELD PLOT
1.0
.1
.01
10^{-3}
10^{-2}
10^{-1}
1
t (DAYS)


Full Logarithmic, 3 x 5
1/u_A
WATER TABLE, FULLY PENETRATING, CONSTANT Q (time-DRAWDOWN)
r/D
1.0
1.5
2.0
2.5
W(u_A, r/D)
1/u_r
1/u_y